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A decade of change in the  
saproxylic beetle fauna of  
eucalypt logs in the Warra  
long-term log-decay  
experiment, Tasmania

**Technical Report 10/2011**

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L = 4.3 mm

Tasmanian Forest Insect Collection - copyrighted image by Lynne Forster

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This review of recent scientific research and publications on fire and carbon in managed and unmanaged forests has been written in an Australian context to inform current debate.

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Front cover image: *Hymaea succinifera* (Phloeostichidae)  
– one of the commonly sampled saproxylic beetle species  
in the log-decay experiment. Image by Lynne Forster.

## Summary

The first decade of sequential and cyclical sampling of saproxylic beetles by means of eclector traps on twelve freshly-felled *Eucalyptus obliqua* logs at Warra, Tasmania has allowed documentation of a taxonomically and ecologically diverse fauna present in such logs in their early decompositional state. About half of all species are apparently undescribed – a much higher proportion than in most temperate regions. The distribution of individuals among species is typically skewed, with most species being rare and few being common. Neither obligately nor facultatively saproxylic beetles dominate the fauna, but predators predominate over other larval feeding guilds, and – in accordance with ecological theory for early successional habitats – winged species predominate over functionally flightless species. There is some suggestion that trophic structure changed over the period of the study, with the proportion of functionally flightless species increasing. The fauna shows strong seasonality. While the summer months represent the peak of occurrence for most species (in keeping with the cool-temperate climate), every month has its own particular complement of species, such that a strong seasonal cycle in assemblage composition is apparent throughout the year. The timings of emergence peaks vary among the years represented in this study by up to two months, with the year of latest emergence corresponding to that with the lowest mean annual maximum temperature; no signature of climate change is evident in the data-set.

The study has allowed comparisons between larger-diameter mature and smaller-diameter regrowth log-classes and between successive sampling cycles and years; and consideration of the interplay between these two aspects. The two log-classes support different assemblages, with the mature log-class hosting consistently more species, more unique species, and proportionally more obligately saproxylic species. Assemblages change seasonally and year-to-year, demonstrating succession. While changes in the assemblages of mature and regrowth log-classes follow similar trajectories, they remain distinct at every point in time. These differences remain apparent when considering sub-sets of the assemblages based on the rarity of the species involved, their flightedness, saproxylicity and larval feeding guild. Current levels of reservation of unharvested forest in Tasmania represent a significant conservation achievement for saproxylic and other taxa, but this study suggests a need to also incorporate the conservation of coarse woody debris into production forestry practices. The need is most pressing for logs derived from mature trees. Aggregated retention silviculture offers a promising alternative to clearfelling since it better maintains continuity in the supply of mature trees. In the event of industrial fuelwood-harvesting in clearfelling areas, additional prescriptions will be required to retain logs of all diameters and origins.

Through continuing the Warra long-term log-decay experiment over the next century or more, a more complete picture of the saproxylic beetle fauna will progressively emerge, together with a better understanding of the management requirements of the fauna.

## Introduction

Coarse woody debris (CWD) is widely considered to be one of the primary structural attributes of most forest systems (Lindenmayer and Franklin, 2002), supporting a large proportion of the forest's biodiversity, in particular its saproxylic fungi and invertebrates (Grove and Meggs, 2003). While CWD of all sizes, origins and decompositional stages is utilised by saproxylic species, it appears that large-diameter logs are particularly important, because of their longevity, variable internal structure and sheer bulk, as well as because of their vulnerability to forestry practices. Historically, forestry practices have been implicated in causing the decline of many saproxylic species (Grove, 2002). Most studies affirming this process have taken place in Europe (e.g. (Siitonen, 2001; Müller *et al.*, 2007) where forestry pressures on the remaining, often fragmented and heavily modified, native forests are often intense and long-standing. In Tasmania, intensive production forestry in native eucalypt forests generally takes place in the context of extensive tracts of native forest that are still in their first silvicultural rotation and that occur in a matrix with unharvested forest, much of which is reserved (Commonwealth of Australia, 1997). Significant mature-forest elements ('old-growth') remain widespread, along with regrowth elements derived from wildfires which are the dominant natural disturbance agent (Turner *et al.*, 2009). Currently, CWD is abundant in most stands, whether unharvested or harvested, and large-diameter logs remain common (Woldendorp and Keenan, 2005). Nevertheless, as forestry intensifies, there is a risk that future forest structure in the managed parts of the landscape will become increasingly impoverished with regard to large, old trees and hence in the large-diameter logs that are generated when such trees die. Hence while few Tasmanian saproxylic species are currently threatened by forestry practices (Grove and Meggs, 2003), many more could become so in the future if there were no mitigation measures.

The Warra long-term log-decay experiment was established in 1999 as part of the response by the research community to heightened awareness of the ecological role of coarse woody debris in forest ecosystems (Harmon *et al.*, 1986). In particular, it was set up to help develop a greater understanding of the ecological value of large-diameter logs derived from 'mature' trees relative to smaller-diameter logs derived from 'regrowth' trees. While long-term supplies of the latter seem secure in the production forest, those of the former are less so (Grove and Meggs, 2003). The experiment is intended to run for decades, or indeed centuries, since this is the likely time-frame for the decomposition of the logs involved (Grove *et al.*, 2009b); and it is intended to facilitate a science-based approach to ecologically sustainable forest management. Its focus is on saproxylic beetles only, rather than the full spectrum of saproxylic taxa, because in the local context beetles have proved amenable to sampling (using simple traps) and to dry-storage (pinned or carded), and are relatively tractable taxonomically (Baker *et al.*, 2009).

Rotting logs can occur at high densities in natural forests, especially locally in Tasmania (Woldendorp *et al.*, 2004). In the case of southern Tasmanian *Eucalyptus obliqua*, rotting logs may take centuries to decompose (Grove *et al.*, 2009b). However, the appearance, structure and chemical composition of rotting logs change markedly as they decay, as is evidenced by our ability to define sequences of decay-classes. In *E.obliqua* logs, the first of five decay-classes (the subject of the present study) has the shortest duration (Grove *et al.*, 2009b), implying that the rate of change is most rapid early in the log's decomposition. In general, a species' powers of

dispersal, and length of life-cycle, tend to be inversely related to the abundance and durability of its breeding habitat (Pianka, 1970; Southwood, 1977; Stearns, 1977). Winged species would be considered to be potential dispersers over greater distances (and perhaps have other characteristics of r-strategists) than functionally flightless species, which might meet more of the criteria for K-strategists (Pianka, 1970). On this basis, logs should initially harbour rapidly reproducing species with the means to disperse rapidly and over longer distances; but as decomposition progresses, rotting logs might increasingly favour slowly reproducing species for which short-distance dispersal mechanisms such as crawling are adequate (Baur *et al.*, 2005; Schmuki *et al.*, 2006). Theory would therefore suggest - and others have found (Langor *et al.*, 2008) - that the representation of flightlessness in beetle assemblages should increase with decomposition.

Trophic structure might also be expected to change over time as the logs decompose. Initially, bark- and other wood-feeders might be expected to predominate, while as decomposition proceeds and resources such as bark are exhausted, fungus- or detritus-feeders might come to the fore, along with predators. Generally, predators would be expected to be rarer (or have lower biomass) than their prey (Pimm, 1977). The present study provides an opportunity to test several ideas about life-history strategies and trophic structure in early successional logs, and how they may change as logs decompose.

#### *Faunal relationships with log-class (independent of time)*

Diameter is an attribute of a log thought to have great relevance for the saproxylic fauna (Grove, 2002a). This stems from diameter being a readily measurable surrogate for a suite of ecological attributes that characterise logs of different sizes. For example, larger-diameter logs have a smaller surface-area-to-volume ratio than smaller-diameter logs, and so tend to offer greater amounts of substrates that are well-buffered from the external environment and in which temperature and humidity do not fluctuate markedly. Additionally, they tend to be derived from older trees with a higher proportion of heartwood relative to sapwood, and may inherit some of the trees' well-developed internal structures (including hollows) and decomposer assemblages (Yee *et al.*, 2006). These in turn may affect the nature of decompositional and fragmentation processes in the log, with flow-on effects on the log's internal structure and how this changes over time. Thus larger-diameter logs tend to have more internal structural complexity, to decay primarily from the inside outwards, but to change more slowly over time. Meanwhile, smaller-diameter logs tend to decay more rapidly and more uniformly, but tend to do so more from the outside inwards (Wardlaw *et al.*, 2009).

This being the case, the saproxylic fauna should show some relationships with log-class or diameter. This has been asserted by many (see Grove, 2002a for a review), and attested by few (e.g. Yee *et al.*, 2006). Beyond plain differences, it is often noted that large-diameter logs are more 'special' than small-diameter logs, harbouring more species, including many more that are unique to logs in this log-class. This trait is based partly on the more complex ecology of logs derived from mature trees. However, it also relates to their greater vulnerability to forestry practices, since, in the absence of mitigation measures, intensively managed forests tend to be deficient in the large-diameter (i.e. mature) trees that are the sole precursors of large-diameter logs (Siitonen, 2001). Commercial rotations are usually simply not long enough to

permit their development, and in any event, the trees are harvested, precluding their progression to logs (Duvall and Grigal, 1999; Hagan and Grove, 1999; Grove and Meggs, 2003; Gibb *et al.*, 2005; Debeljak, 2006). The experimental design of this study allows the explicit testing of the relationship between the saproxylic beetle fauna and log-class.

The experimental design of the current study was predicated on the supposition that a tree's ecological maturity may have more explanatory power than log diameter *per se*; this supposition is the basis for most of the analyses presented here. Nevertheless, it is also important to consider the geometrical relationship of diameter with surface area and with volume. When Harrison (2007) explored this for saproxylic beetles in living *E. obliqua* trees of different ages (and hence sizes) in Tasmania, she determined that comparisons of species density among tree-ages based on surface area tended to rank the youngest trees as most species-dense and the oldest the least species-dense, whereas by volume the reverse was true. But she also found that if only surface-dwelling species were considered, all tree-ages appeared similarly species-dense when rarefied by surface area, while if only wood-dwelling species were considered, then all tree-ages appeared similarly species-dense when rarefied by volume. Having explored a range of rarefaction and extrapolation techniques, she concluded that basing conclusions on small samples was bound to lead to these interpretative difficulties but that the most logical comparison was on the basis of extrapolating species density up to the volume of the trees in question, since these represent natural habitat-units in the forest. Under this latter approach (which parallels the experimental design of the current study), the oldest trees were by far the most species-rich, and the youngest the least so. The experimental design of this study allows the explicit testing of the relationship between the saproxylic beetle fauna and log-class, as well as surface area and volume.

#### *Faunal succession (independent of log-class)*

Logs are dynamic entities, albeit over extended time-scales that make the processes of decomposition difficult for humans to perceive. Saproxylic beetles operate over much shorter time-scales, having life-cycles of one or a few years and showing strong seasonality. Many depend on tightly-defined structural or chemical attributes of a decaying log and on intimate relationships with many other species, each of which may have its own tightly-defined niche (Leach *et al.*, 1937; Schowalter *et al.*, 1992; Podlaski, 1996). Thus a log's state of decomposition is likely to be critical to a beetle species' ability to colonise and occupy it (Savely, 1939); indeed the beetles themselves may be important contributors to the decomposition process (Edmonds and Eglitis, 1989; Hammond *et al.*, 2001).

Saproxylic beetle assemblages are expected to progressively change over time as a log decomposes, with directional change to be superimposed on a seasonal pattern. Log decomposition itself is unlikely to be a linear process, with the rate of decomposition reflecting the complexities of the processes involved, which in turn depend on the structural and chemical attributes of the log at the time (Harmon *et al.*, 1986; Dix and Webster, 1995; Garrett *et al.*, 2007; Barker, 2008). Generally, change is likely to be most rapid early in a log's life (Boddy *et al.*, 1989), assuming that the log was derived directly from a living tree rather than a standing dead one. To take advantage of the transient resource present in logs at the start of their decomposition, colonising beetles would be expected to have characteristics enabling them to rapidly colonise, such as

the presence of wings, and for many such species to be stenotypic (i.e. obligately saproxylic, particularly wood-feeding). However, sometimes the very complexity of the biochemical mix inherited from the living tree may hinder a log's decomposition for a few years, giving rise to a lag-time before rapid decomposition commences (Mackensen *et al.*, 2003).

#### *Combined influences of log-class and time on the fauna*

Since a log's origin may influence both the nature of the associated saproxylic beetle assemblage and the rate and trajectory of decomposition, it seems likely that changes in these assemblages will also follow different trajectories according to log-class. It is also possible that differences may exist between obligately and facultatively saproxylic species, between winged and functionally flightless species, and among species belonging to different larval feeding guilds. The experimental design of this study allows these facets to be explored in some detail.

#### *The ecological significance of rare species*

Rare species are very hard to meaningfully include in many analyses (Cao *et al.*, 2001) because of their low probability of detection (McArdle, 1990) and because they can create 'zero-inflated' data-sets that can fool some measures of similarity used in multivariate analyses (Cao *et al.*, 2001). Consequently, such species are regularly ignored, sometimes through purposeful exclusion. Yet as McArdle (1990) put it, 'rare species are very common', comprising a significant proportion of every assemblage. Furthermore, rare species tend to be those of most conservation concern, so finding ways to detect them can be important (Martikainen and Kouki, 2003; Hedgren and Weslien, 2008). Working on a data-set of beetles sampled with pitfall traps, Driscoll (2010) determined that this common pattern translates into very low detection probabilities (for individual traps) for some 95% of all the species sampled – but even his analysis had to exclude the rarest species. Rare species are often considered to be minor players in ecosystem functioning, but Lyons *et al.* (2005) argue that this may be partly because of the analytical techniques used, particularly a tendency to exclude rare species. The large data-set arising from the present study presents an opportunity to consider the role of rare species in more detail.

## Methods

### *The study area*

The study area lies in State forest within the Warra Long-Term Ecological Research site, at UTM latitude 49.0908S, longitude 146.6595E and at an altitude of about 250 m asl. The forest in the vicinity comprises lowland wet *Eucalyptus obliqua* forest with a rainforest understorey (mixed forest), in which two cohorts of *E. obliqua* trees are apparent. In this part of Tasmania, this forest structure typically develops in parts of the landscape where wildfire events are patchy in their impact and sufficiently infrequent for rainforest elements to survive alongside the post-wildfire-regenerated eucalypts (Jackson, 1968). One of the two cohorts (*mature*) comprised trees which were considered to be survivors of the last significant wildfire(s) in the study area (1934 and/or 1914 and/or 1898) (Alcorn *et al.*, 2001), and to pre-date these by at least a century; the other (*regrowth*) comprised trees considered to have regenerated in the immediate aftermath of the most recent of these wildfires.

### *The study logs*

Twelve *E. obliqua* trees were selected for this study – six mature (M) and six regrowth (R). These trees were felled into small gaps created beforehand in the surrounding forest. Prior to felling, trees were randomly allocated to mature-regrowth pairs (M1 + R1, M2 + R2 etc.). This numbering system was carried over into the two log-maturity classes (*log-classes*) thus created. The first two pairs (1 + 2) were felled in May 1999, the second two (3 + 4) in October 1999 and the final two (5 + 6) in February 2000.

### *The sampling strategy*

Five 3-metre lengths (*logsections*) were delineated on each log at the start of the study. These were randomly allocated a number between 1 and 5, with these numbers being used to decide on the order in which logsections were sampled by means of emergence tents (*eclectors*). The small-end diameter of each logsection was recorded, and used to calculate volume and surface area (Appendix 1), based on an assumption that a logsection was cylindrical with a diameter equal to that of its small-end diameter.

The study was divided into consecutive five-year sampling periods (*cycles*), the first two of which are the subject of this paper. Each cycle was further divided into monthly sampling occasions (*sample series*). During each cycle, each of the 60 logsections was enclosed in an eclector for a continuous span of approximately two years, with an intervening period of approximately two years of exposure between the two periods of enclosure (Appendix 1). Each eclector was furnished with three collecting-heads – one upper and two lower (one on the log's left-hand side and one on its right-hand side). Upon collection, the two lower samples were merged, such that each sample series comprised two samples. On any given log, the timing of enclosure of consecutively numbered logsections with their eclectors was staggered by approximately six months.

There were some minor deviations to the sampling schedule from this 'two-years-enclosed, two-years-exposed' strategy. The period of enclosure was always longer than two years for Cycle 1 (range: 30 to 40 months), while for Cycle 2 the range was from 20 to 25 months. In those few cases in Cycle 2 when the period of enclosure fell short of two full years, this was due to the eclector not being in position over one or all of the winter months (June-August) either preceding or following the main period

of enclosure. During Cycle 1, a further cause of deviation to the sampling schedule was when winter servicing was postponed by a month or two, resulting in some lumping of samples across multiple series. In nearly all cases, lumping was within the winter season, rather than impinging on the following spring sample series.

Thus while the notional number of sample series was 117 (spanning 9 years and 9 months), in practice, only 111 resulted in collections. Over Cycles 1 and 2, these gave rise to 7186 samples (4330 from Cycle 1 and 2856 from Cycle 2). A few of these were void because of damaged collecting-heads, for instance due to the unwanted attentions of devils or quolls. In the analyses that follow, no special allowance has been made for them: they have been treated as equivalent to the many other samples that were devoid of beetles despite no obvious signs of damage or interference.

#### *Species determinations and descriptors*

All beetles were extracted from their samples and dry-mounted for inclusion in the Tasmanian Forest Insect Collection (TFIC) at Forestry Tasmania, Hobart. All were identified to the level of species. Where a formal scientific name could not be attached to a species, a higher taxonomic name was used instead, in combination with a collection-specific code-name. Taxonomic and ecological information relating to the species in the present study has been progressively compiled on the website of the TFIC ([www.tfic.net.au](http://www.tfic.net.au)), gleaned from the large body of ecological and taxonomic literature cited therein, as well as from related research at Warra and beyond. See also Baker *et al.* (2009) for details of some relevant taxonomic publications.

On the basis of this information, each species was assigned to a single ‘saproxylicity’ category, based on its likely strength of association with dead wood. *Obligately saproxylic* species ( $Sx^{++}$ ) are those considered to breed only in dead wood or in wood-decaying fungi, while *facultatively saproxylic* ( $Sx^{+}$ ) species are those considered to additionally make use of other habitat for breeding (such as leaf-litter or non-wood-decaying fungi); *non-saproxylic* species ( $Sx^{-}$ ) are those considered to have no direct breeding association with dead wood or wood-decaying fungi. Also on a similar basis, each species was subjectively assigned to a single larval feeding guild, viz. *wood-feeder* (includes bark-, phloem- and xylem-feeders), *fungus-feeder*, *detritus-feeder*, *predator* and *other/unknown*. Likewise, each species was also allocated to a single ‘flightedness’ category: species were categorised as either *winged and assumed capable of flight* ( $F^{+}$ ) or *functionally flightless* ( $F^{-}$ ). Analyses arising from the use of these classifications must be viewed in the light of the subjectivity of the allocations, and the difficulties involved in validating them for such a poorly known fauna.

#### *Data compilation*

It was not possible to use the entire beetle data-set for every analytical purpose, because of asymmetrical sampling effort between cycles and among years, and at any given point in time among eclectors and logs. Thus different portions of the entire data-set were compiled for different analytical purposes:

- *Data-set 1* comprised the entire beetle data-set from all samples – considered valid for exploring the taxonomic and functional composition of the sampled beetle fauna.
- *Data-set 2* represented single years of continuous sampling from each eclector, defined in terms of years-since-felling. For this purpose, the variable-length

period of enclosure of each eclector was broken into year-long segments of continuous enclosure, with the cut-off points for the start and end of individual years based on the date of felling for the log in question. Some flexibility in allocation was necessary to maximise the number of segments, for instance by shifting the cut-off point forward or backward by a month (but only where the cut-off point fell in the period from late autumn to early spring). Sample series lying outside these segments were excluded. On this basis, a total of eight years-since-felling were represented across all logs (Table 1), by 20 eclector-years of sampling per log. In this data-set, the number of enclosed electors was constant among all logs for a given year but varied among years. To allow this to be factored into some analyses, electors were randomly allocated to groups of one eclector per log per year. This gave rise to a single group in Years 0, 4, 5 and 8; to three groups in Years 1, 3, 6 and 7; and to four groups in Year 2.

- *Data-set 3* was based on *Data-set 2*, but was compiled to eliminate the year-by-year variation in the number of enclosed electors while maximising the within-year replication. It comprised the first three groups for Years 1, 2, 3, 6 and 7. It therefore excluded the fourth group for Year 2 and the sole groups in Years 1, 4, 5 and 8.
- *Data-set 4* represented two years of continuous sampling from each eclector from each cycle. Sample series lying beyond the 24 chosen months were excluded from the data-set (Table 1), allowing the two cycles, and logs-classes within cycles, to be compared on an equal footing.

Additionally, subsets of these data-sets were compiled for specific analytical purposes, for instance to exclude non-saprophytic species or to exclude singletons.

#### *Climate data*

Reliable, systematic collection of relevant climate data at Warra post-dates the start of this study. Instead, for examining climatic influences on seasonality of emergence, mean annual maximum temperature data were obtained from the Australian Bureau of Meteorology for climate-stations at Strathgordon (situated some 65 km to the NW of Warra) and Hobart (situated some 65 km to the NE). Annual temperature anomalies were then compared with deviations from mean month of emergence.

#### *Analyses*

The source data for all analyses reside in an *Access*<sup>TM</sup> database, from which queries were run to compile specific data-sets for different purposes. The program *PC-ORD* (McCune and Mefford, 2006) was used for multivariate analyses, including non-metric multidimensional scaling (NMS), hierarchical (agglomerative) cluster analysis, non-parametric multivariate and univariate analysis of variance, indicator species analysis and multi-response permutation procedures (MRPP). For all NMS ordinations, the Bray-Curtis distance measure was selected, and all species abundance data were square-root-transformed to reduce (but not eliminate) the influence of the more numerous species relative to less numerous ones. Except where otherwise stated, the 'slow and thorough, autopilot' mode was selected, involving 250 repeat runs of the real and randomised data, to maximise the chances of detecting global minima. In presenting the results, the two axes selected were either the only two available (for two-dimensional solutions) or the most informative two (for three-dimensional solutions); in some cases, axes were rotated to facilitate interpretation.

Table 1. Periods of operation for the groups of samples comprising Data-set 2.

Year/Log	M1, R1	M2, R2	M3, R3	M4, R4	M5, R5	M6, R6
<b>Yr 0</b> (1 grp)	JUN-99 to MAY-00	JUN-99 to MAY-00	OCT-99 to SEP-00	OCT-99 to SEP-00	MAR-00 to FEB-01	MAR-00 to FEB-01
<b>Yr 1</b> (3 grps)	JUN-00 to MAY-01 <sup>(1)</sup>	JUN-00 to MAY-01 <sup>(3)</sup>	OCT-00 to SEP-01	OCT-00 to SEP-01	MAR-01 to FEB-02	MAR-01 to FEB-02
<b>Yr 2</b> (4 grps)	JUN-01 to MAY-02	JUN-01 to MAY-02	OCT-01 to SEP-02	OCT-01 to SEP-02	MAR-02 to FEB-03	MAR-02 to FEB-03
<b>Yr 3</b> (3 grps)	JUN-02 to MAY-03 <sup>(2)</sup>	JUN-02 to MAY-03 <sup>(4)</sup>	OCT-02 to SEP-03	OCT-02 to SEP-03	MAR-03 to FEB-04 <sup>(5)</sup>	MAR-03 to FEB-04 <sup>(6)</sup>
<b>Yr 4</b> (1 grp)	MAY-03 to APR-04	MAY-03 to APR-04	OCT-03 to SEP-04	OCT-03 to SEP-04	DEC-03 to NOV-04	DEC-03 to NOV-04
<b>Yr 5</b> (1 grp)	OCT-04 to MAY-05	OCT-04 to MAY-05	OCT-04 to SEP-05	OCT-04 to SEP-05	MAR-05 to SEB-06	MAR-05 to FEB-06
<b>Yr 6</b> (3 grps)	JUN-05 to MAY-06	JUN-05 to MAY-06	OCT-05 to SEP-06	OCT-05 to SEP-06	MAR-06 to FEB-07	MAR-06 to FEB-07
<b>Yr 7</b> (3 grps)	JUN-06 to MAY-07	JUN-06 to MAY-07	OCT-06 to SEP-07	OCT-06 to SEP-07	MAR-07 to FEB-08	MAR-07 to FEB-08
<b>Yr 8</b> (1 grp)	JUN-07 to MAY-08	JUN-07 to MAY-08	OCT-07 to SEP-08	OCT-07 to SEP-08	MAR-08 to FEB-09	MAR-08 to FEB-09

<sup>(1)</sup> AUG-00 to May-01 for M1 Group 2 and for R1 Group 3; <sup>(2)</sup> MAY-02 to APR-03 for M1 Group 1 and for R1 Group 3; <sup>(3)</sup> AUG-00 to May-01 for M2 Group 3; <sup>(4)</sup> MAY-02 to APR-03 for M2 Group 2 and for R2 Group 1; <sup>(5)</sup> DEC-02 to NOV-03 for M5 and R5 Groups 2; <sup>(6)</sup> DEC-02 to NOV-03 for M6 and R6 Groups 3.

For cluster analysis, the Bray-Curtis distance measure and the group-averaging linking methods were selected, and in presenting the results the scale-axis was log-transformed. For indicator species analysis, the *IndVal* routine (Dufrêne and Legendre, 1997) was implemented, using non-transformed data. The *MRPP* routine (Zimmerman *et al.*, 1985) was also implemented using non-transformed data, with Euclidean distance, and with the recommended  $n/\text{sum}(n)$  weighting.

For analyses of variance (ANOVA), the *Permanova* routine (Anderson, 2001) was implemented, and 4999 randomisations performed. For multivariate ANOVA (log-level assemblages grouped by Cycle), the Bray-Curtis distance measure was selected and the data were square-root-transformed prior to conducting a two-way factorial analysis (logs as Factor 1; Cycles as Factor 2); while for univariate data (individual species abundances), the Euclidean distance measure was selected and non-transformed data were used, so as to perform a standard one-way analysis.

Species accumulation (collectors') and rarefaction curves were calculated using the program *EstimateS* (Colwell, 2004), without randomisation. For sample-based rarefaction, the incidence-based binomial mixing (Mao-Tau method of moments) approach (Colwell *et al.*, 2004) was used as an alternative to randomisation. For individual-based rarefaction, the Coleman approach (Coleman, 1981) was used. *EstimateS* was also used to calculate the Chao1 estimator of expected species richness (Chao, 1984), considered to be most relevant for data-sets of this nature (Colwell and Coddington, 1996).

## Results

### *Sampling efficacy and adequacy of the original and derived data-sets*

Data-set 1 comprised 17194 beetles, assigned to 453 species. Data-set 2 comprised 14203 beetles of 430 species, thus representing 83% of the individuals and 95% of the species present in Data-set 1. Data-set 3 comprised 9706 beetles of 383 species, thus representing 56% of the individuals and 85% of the species present in Data-set 1. Data-set 4 comprised 12792 beetles of 408 species, representing 74% of the individuals and 90% of the species present in Data-set 1.

In Data-set 1, of the 3600 possible samples (lower and upper collecting-heads combined), 838 were void of beetles, 2258 contained fewer than ten beetles, another 484 contained from ten to 50 beetles, and only 20 contained more than 50. The mean number of individuals per eclector-month sample was 4.89 (range: 0-100), and the mean number of species was 3.19 (range: 0-31).

### *The nature of the sampled beetle fauna*

Taxonomic details and ecological traits for the 453 species of beetle sampled during this study are given in Appendix 2. Of these species (Data-set 10, 224 (49%) bore formal scientific names and 229 (51%) lacked them. They were members of 59 beetle families (Table 2). The most species-rich family was Staphylinidae (rove-beetles: 109 species), followed by Curculionidae (weevils: 77 species), Leiodidae (round fungus-beetles: 25 species), Elateridae (click-beetles: 21 species) and Carabidae (ground-beetles: 19 species). Also notable in their richness were the families Scirtidae (12 species), Cerambycidae (10 species) and Lucanidae (5 species).

The overwhelming majority of species and individuals were considered to be saproxylic (Figure 1): 195 species (43%) obligately saproxylic (represented by 9299 individuals, or 54% of the total), and 217 (48%) facultatively saproxylic (represented by 7919 individuals, or 46% of the total); the remaining 41 species (9%) were considered to be not saproxylic (represented by 376 individuals, or 2% of the total). Some 389 species (86%), were considered to be winged and capable of flight (represented by 14010 individuals, or 80% of the total), with the remaining 64 species (14%) considered to be functionally flightless (represented by 3584 individuals, or 20% of the total). There were more species whose larvae were considered to be predatory, comprising over a third of all individuals and species, than for any other feeding-guild. Fungus-feeders comprised about a fifth of all species but over a third of all individuals. Wood-feeders comprised about a quarter of all species and a fifth of all individuals, while detritus-feeders comprised far fewer species and individuals. Most of the 9% of species in the 'other/unknown' category were apparently rare, comprising only 2% of all individuals.

Few species were common and most species were rare (Figure 2). In Data-set 1, singletons comprised 107 species (24% of the total), a further 222 species (49%) were represented by between two and ten individuals, 80 (18%) by between eleven and 50 individuals and only 43 (9%) by more than 50 individuals. The mean number of individuals per species was 37.96 (range: 1 to 2053). The most numerous species was *Hymaea succinifera*, closely followed by *Aleocharinae* TFIC sp 66 (1962), *Quedius sidneensis* (1622) and *Platypus subgranosus* (1128). These four species together comprised 39% of the individuals in the entire data-set. The most numerous non-saproxylic species (ranked 35<sup>th</sup>) was *Paropsisterna bimaculata*. All but two of the

species were considered locally native. The two non-native species were both bark-beetles: *Hylastes ater* (6 individuals) and *Hylurgus ligniperda* (42 individuals). From Data-set 3, the 30 most numerous species accounted for 80.3% of the individual beetles in the data-set; and the 100 most numerous species accounted for 93.7% of the individuals.

Table 2. The number of sampled species in each beetle family, based on Data-set 1 and listed in order of decreasing numbers of species per family.

<b>Family</b>	<b>Species</b>	<b>Family</b>	<b>Species</b>
Staphylinidae	109	Anthribidae	2
Curculionidae	77	Attelabidae	2
Leiodidae	25	Brentidae	2
Elateridae	21	Cantharidae	2
Carabidae	19	Cerylonidae	2
Chrysomelidae	14	Ciidae	2
Scirtidae	12	Clambidae	2
Cerambycidae	10	Erotylidae	2
Melandryidae	9	Melyridae	2
Tenebrionidae	9	Prostomidae	2
Coccinellidae	8	Ptiliidae	2
Cryptophagidae	8	Scraptiidae	2
Latridiidae	8	Archeocrypticidae	1
Scarabaeidae	8	Biphyllidae	1
Byrrhidae	7	Boganiidae	1
Cleridae	7	Bothrideridae	1
Nitidulidae	7	Buprestidae	1
Zopheridae	7	Dermestidae	1
Anobiidae	6	Derodontidae	1
Lycidae	6	Dytiscidae	1
Lucanidae	5	Histeridae	1
Corylophidae	4	Hobartiidae	1
Eucnemidae	4	Mordellidae	1
Laemophloeidae	4	Mycteridae	1
Oedemeridae	4	Phloeostichidae	1
Aderidae	3	Salpingidae	1
Phalacridae	3	Sphindidae	1
Pyrochroidae	3	Throscidae	1
Silvanidae	3	Trogossitidae	1
Anthicidae	2		

Overall, the majority of individuals and species were collected from the lower collecting-heads: 9609 individuals (56%) from 346 species (76% of all species), as opposed to 7985 individuals (44%) from 325 species (72% of all species) from the upper collecting-heads. From the lower collecting-heads, 77% of individuals were from the 82% of species considered to be capable of flight, while the corresponding figures for the upper collecting-heads were 83% (individuals) and 87% (species). At least for the 30 most numerous species, the majority of species show marked differences in numbers captured between lower and upper collecting-heads (Figure 3).

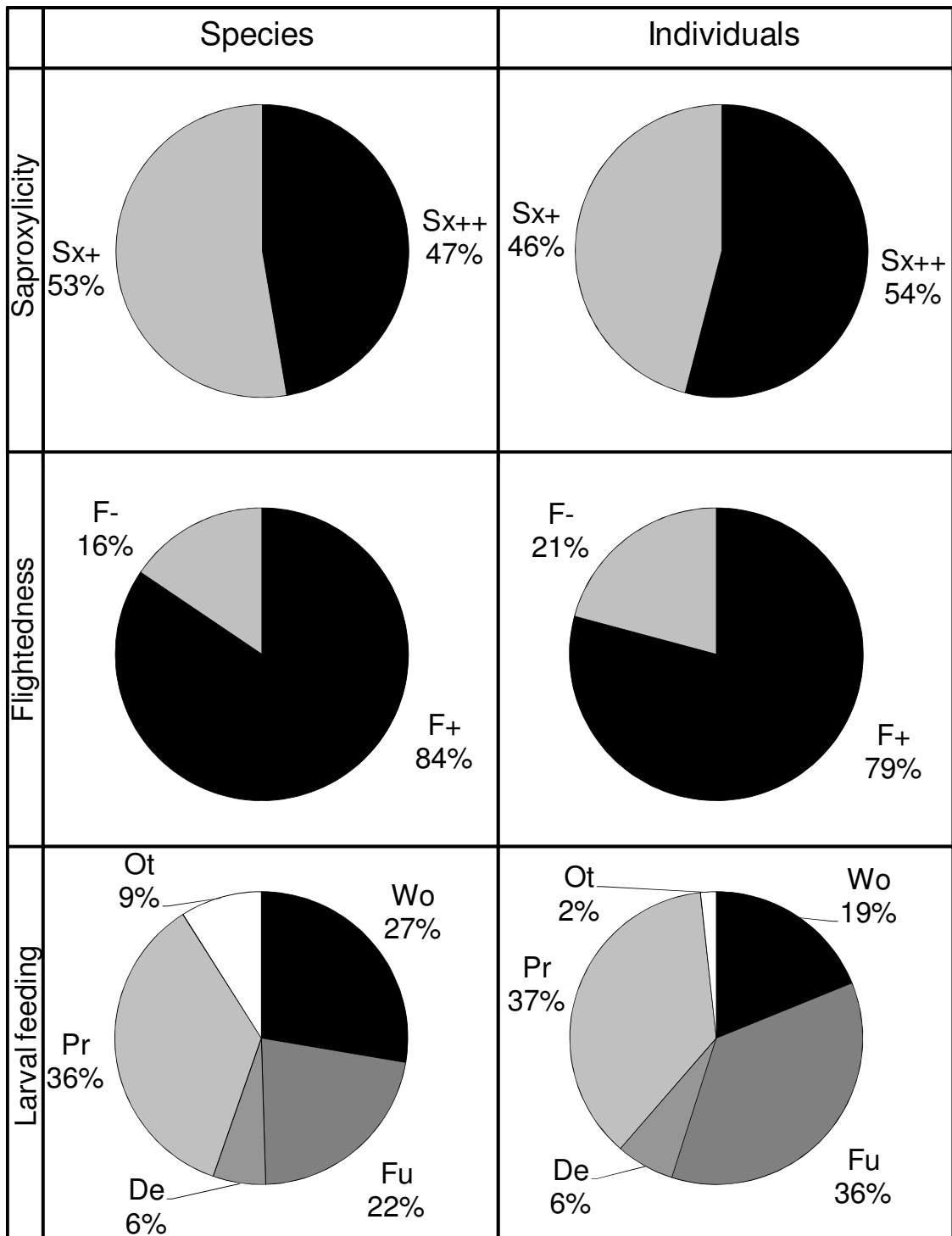


Figure 1. Proportional representation of saproxylic beetle species and individuals according to saproxylicity, flightedness and larval feeding guild, based on Data-set 1. Saproxylicity categories:  $Sx^-$  = non-saproxylic;  $Sx^+$  = at least facultatively saproxylic;  $Sx^{++}$  = obligately saproxylic. Flightedness categories:  $F^-$  = functionally flightless;  $F^+$  = winged and assumed capable of flight. Larval feeding categories: De = Detritus-feeder; Fu = fungus-feeder; Pr = predator; Wo = wood-feeder; Ot = other/unknown.

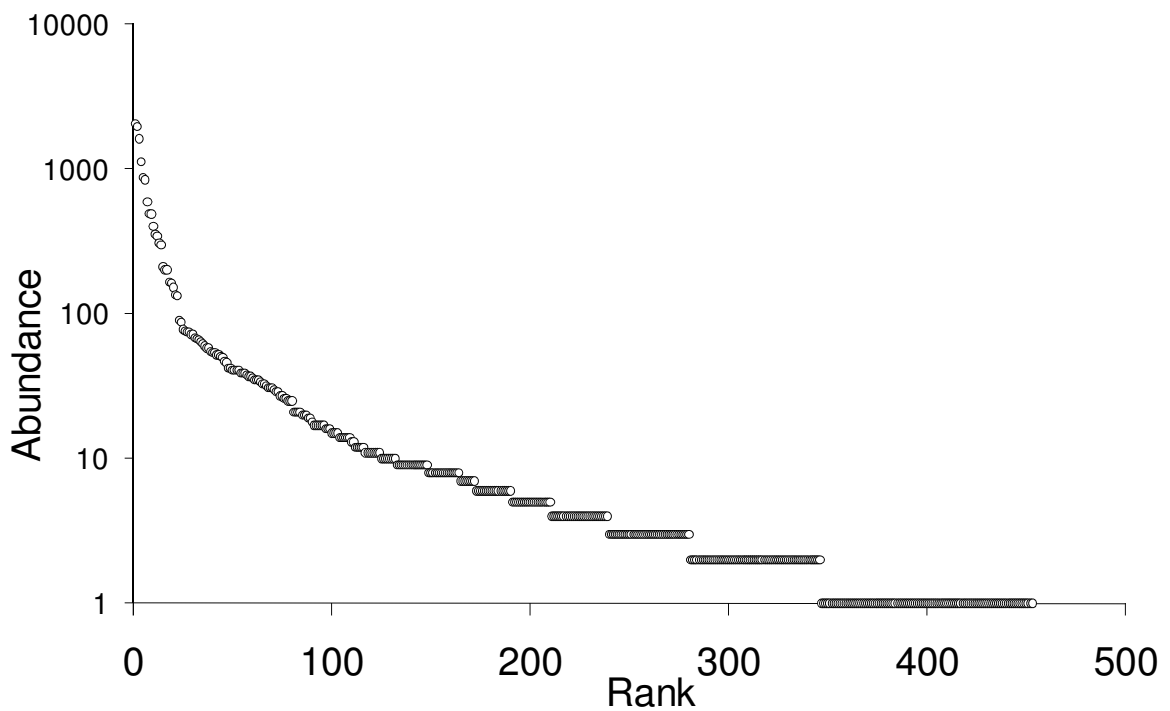


Figure 2. Rank abundance curve for Data-set 1. The y-axis has been log-transformed for greater clarity.

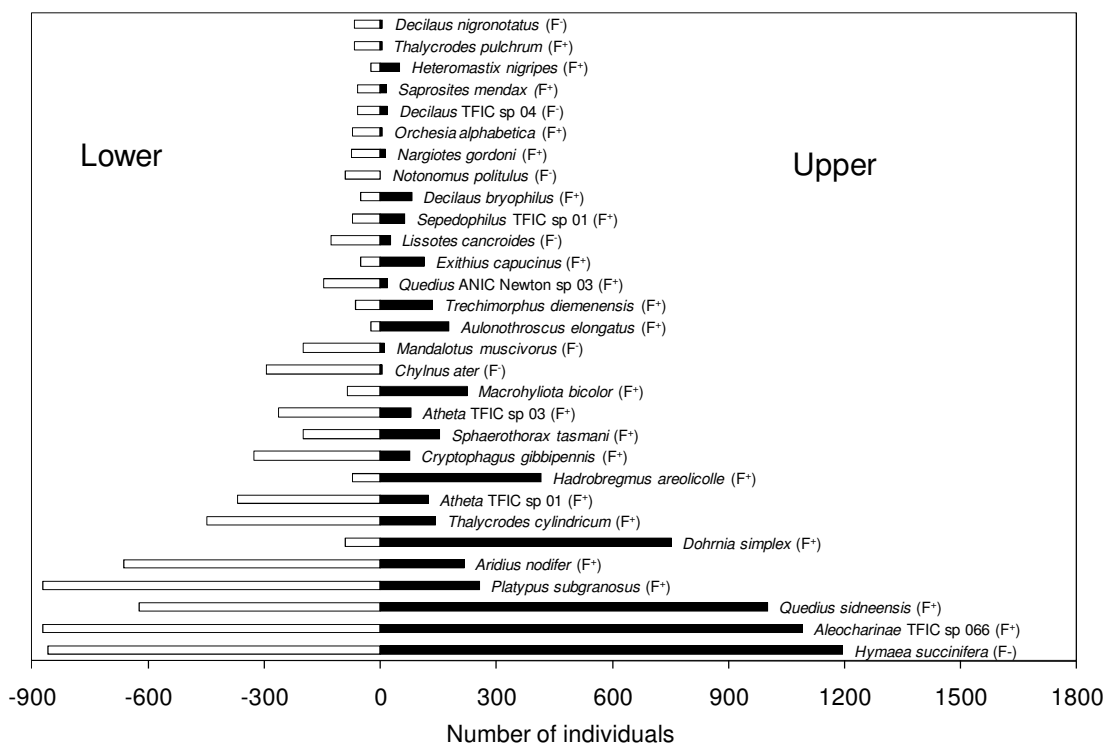


Figure 3. Number of saproxylic beetle individuals by collecting-head, based on Data-set 1. A species' flightedness is denoted by F<sup>+</sup> (winged and assumed capable of flight) and F<sup>-</sup> (functionally flightless).

These differences were usually consistent with their allocation by flightedness category, with functionally flightless species (such as *Chylnus ater*) tending to be over-represented in the lower collecting-heads and winged species (such as *Hadrobregmus areolicolle*) tending to be over-represented in the upper collecting-heads. However, the most numerous species (*Hymaea succinifera*) is functionally flightless yet was slightly more numerous in the upper collecting-heads.

### Seasonality

The summer months (December to February) are those of peak occurrence for most species. In Data-set 2, the number of individuals recorded by month peaked in February (2888), while the number of species peaked in January (235 species); June recorded the lowest number of individuals (213) and species (49) (Figure 4a). Most species were strongly seasonal – indeed, nearly a third of all species were only detected in a single month of the year (Figure 4b). However, a significant minority (4%) of all species were detected in every month of the year. Every month hosted some species at their maximum abundance (Figure 4c). The highest proportion of species (20%) reached their maximum abundance in December, with February and January close behind (18% and 16% respectively) and with June having the lowest proportion of species (<2%). The monthly distribution of those species that were only detected in a single month was remarkably similar to that of maximum abundance, with January hosting the highest proportion, followed by February and December (Figure 4d). These monthly differences translated into the ‘cyclical’ pattern of changes in assemblage composition evident in an ordination plot (Figure 5).

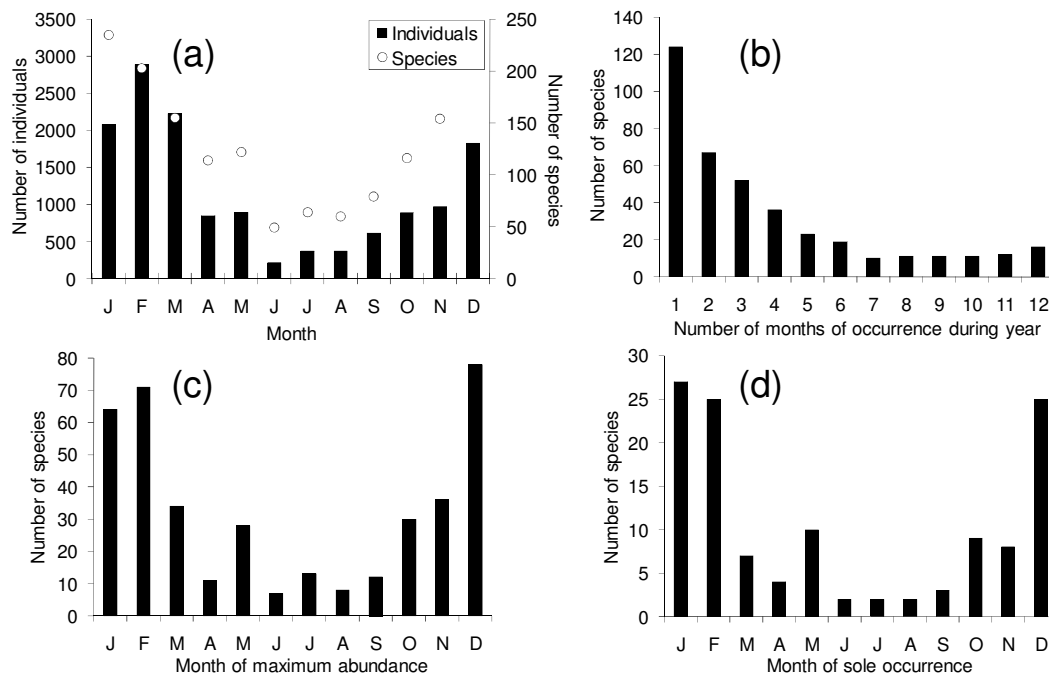


Figure 4. Monthly summary statistics for beetles from Data-set 2: (a) number of individuals (solid bars) and species (open circles) per calendar month; (b) distribution of species by the number of months of the year in which they were sampled; (c) distribution of species by their month of maximum abundance; and (d) distribution of species by month of occurrence, for the sub-set of species which were only sampled in a single month of the year.

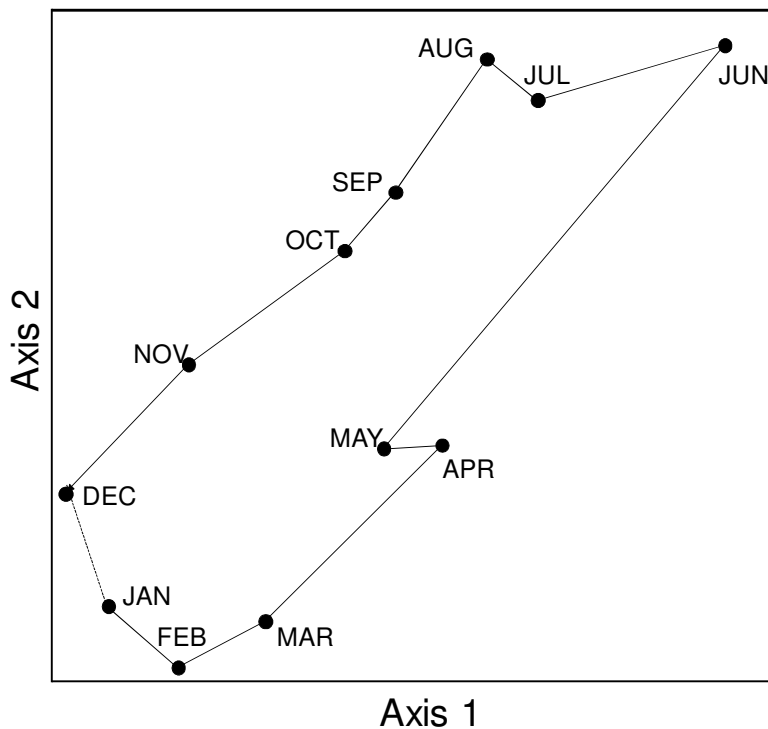


Figure 5. Output from non-metric multidimensional scaling of saproxylic beetle assemblages by month of sampling, based on Data-set 2, but lacking singletons. Both axes of a 2-dimensional solution shown (STRESS = 2.52). Arrows connect consecutive months (in the conventional sense, starting with JAN and ending with DEC; a dotted line has been added to connect DEC to JAN).

Over the study-period, different years differed by up to two months in when species typically emerged (Figure 6), although no long-term trend towards earlier (or later) emergence is apparent. Much the same trend is shown by data based on month of first emergence and by data based on mean month of emergence, but the level of variation is greater for first-emergence data. There is no clear trend in the accompanying climate-station data towards warmer or cooler conditions over the study-period, although there is significant year-to-year variation in mean maximum temperatures. The year starting in July 2004 was the ‘latest’, in terms of both when species were first detected and their mean month of detection; 2004 was also the coolest year locally, in terms of mean maximum temperatures.

*Faunal relationships with log-diameter (independent of time)*

In Data-set 1, more beetle individuals and species were captured by logs in the mature log-class: 9433 beetles (55% of the total), comprising 396 species, compared with 8161 beetles (45% of the total), comprising 335 species, for logs in the regrowth log-class. In the mature log-class, a higher proportion of the individuals and species were obligately saproxylic: 45% of the species and 59% of the individuals, compared with 40% of the species and 46% of the individuals for the regrowth log-class. By contrast, facultatively saproxylic species comprised 46% of the species and 39% of the individuals for the mature log-class, and 52% of the species and 52% of the individuals for the regrowth log-class. The mean numbers of individuals and species per eclector per month were higher for the mature log-class than for the regrowth log-class. For the mature log-class, the figures were 5.24 individuals (range: 0-100), and 3.53 species (range 0-31). For the regrowth log-class, the corresponding figures were

4.53 individuals (range: 0-94), and 2.85 species (range: 0-26).

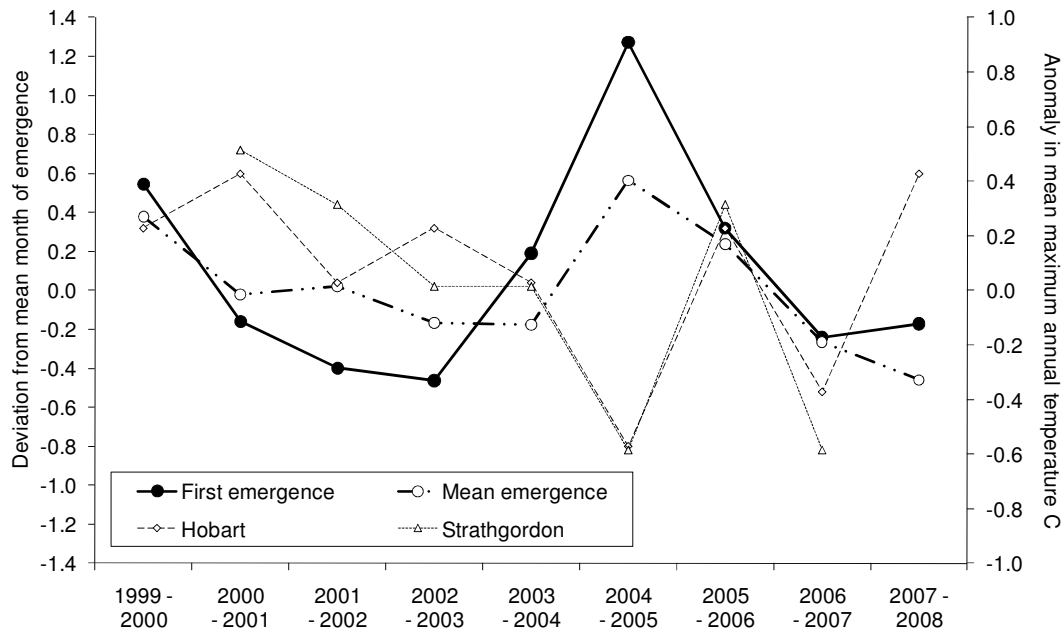


Figure 6. Relationship between the deviations in two indices of mean month of emergence of saproxylic beetles with anomalies in mean maximum annual temperature for two local climate-stations. The indices are based on Data-set 1, for which numerical values for months range from 1 (July) to 12 (the following June). The ‘first emergence’ data-set is based on the mean of the numerical values of the months in which species present in a given year first appeared; while the ‘mean emergence’ data-set is based on the mean of the numerical values of the mean month of occurrence for each species present in a given year. The first and mean emergence data are shown as deviations from the mean of 2000-2006 data. The temperature anomalies presented are their differences from the mean maximum annual temperature for the years 2000-2006 for the climate-station in question, from Australian Bureau of Meteorology data available on-line. Strathgordon lies some 65 km to the NW of Warra, while the Hobart station lies some 65 km to the NE.

In Data-set 2, there was a positive relationship, at the level of individual electors, between the number of individual saproxylic beetles caught and the number of species accrued. Much the same relationship held for logsections in both log-classes, although there was a tendency for species to accrue at a slightly higher rate relative to the number of individuals for electors in the mature log-class compared to those in the regrowth log-class (Figure 7a). Figures 7b and 7c explore the relationship between species density and the logsection’s diameter, expressed as surface area (Figure 7b) and volume (Figure 7c). While in each case logsections in the two log-classes were clearly separated along the x-axis (because of their great differences in diameter), there was no clear indication of differences in the relationship of logsection diameter and species density between the two log-classes. Species density showed a clearer positive relationship with surface area than it did with volume, although in each case the relationship was weak and apparently non-linear (since one would have to assume that logs below a certain surface area or volume would harbour zero species).

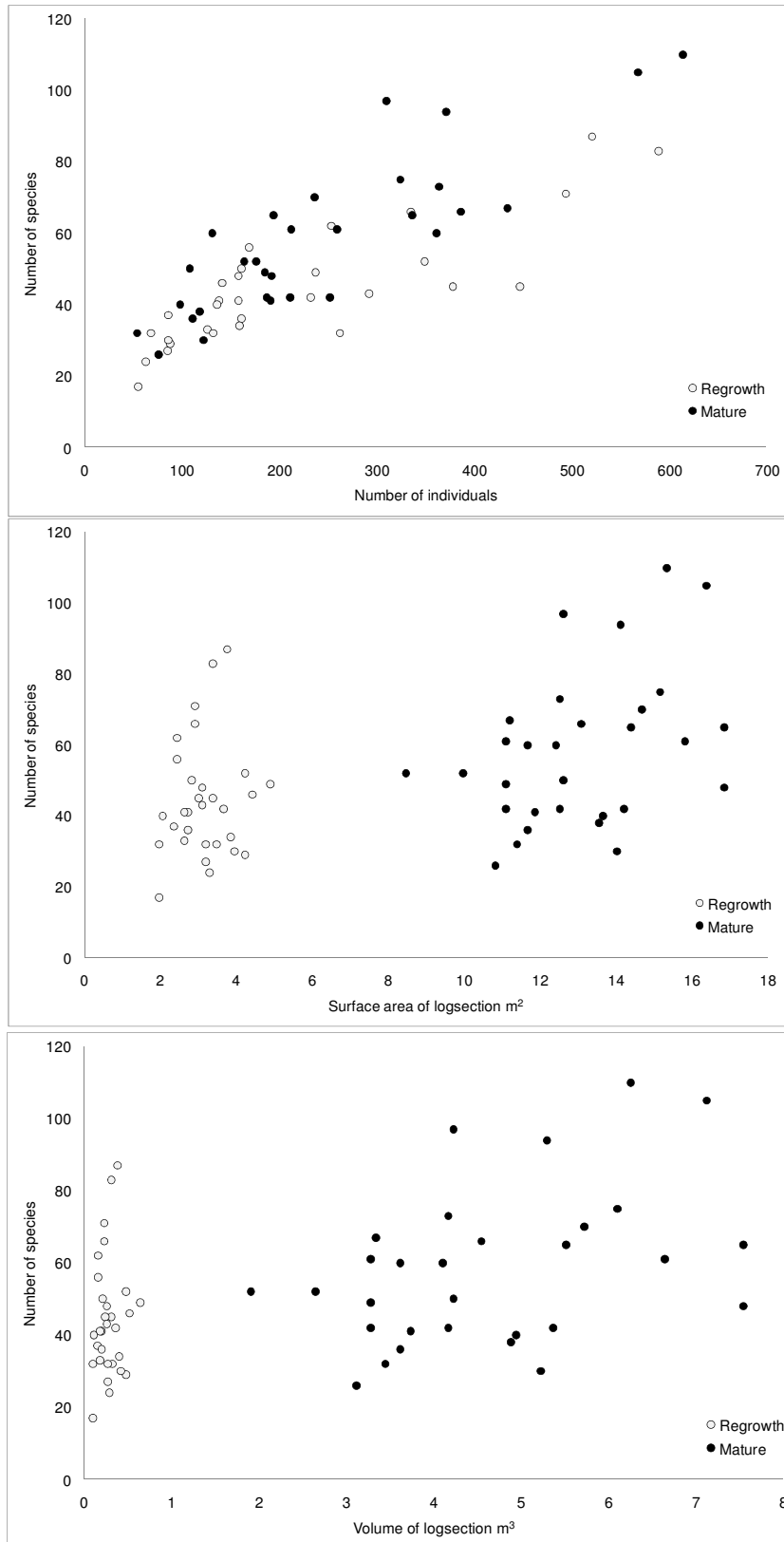


Figure 7. Relationship between (a) eclector-level number of individuals sampled and the number of species accrued; (b) eclector-level species density and logsection surface area; and (c) eclector-level species density and logsection volume, based on Data-set 2. Closed circles indicate logs in the mature log-class; open circles indicate logs in the regrowth log-class.

Of the 392 saproxylic species detected in Data-set 2, more species (335) were present in the mature log-class than in the regrowth log-class (285); more species (107) were unique to the mature log-class (representing 32% of the species recorded from that log-class) than to the regrowth log-class (57, representing 24% of the species recorded from that log-class); and 228 species were shared by both log-classes (Figure 8). At the level of logsections, there were consistently more species in the mature log-class for a given number of individuals caught, compared to the regrowth log-class (Data-set 1: Figure 9a). The rate of log-level accumulation of saproxylic species (Data-set 2) gradually declined as more logs were included, but never reached an asymptote (Figure 9b). At each incremental increase in the number of logs, the number of species sampled was significantly higher in the mature log-class than in the regrowth log-class. With all six logs included per log-class, the Chao1 predictor of ‘final’ species richness was higher for the mature log-class (474 species) (i.e. should it have proven possible to sample many more logs at the same intensity) than for the regrowth log-class (439 species). However, sampling from regrowth logs appears to more rapidly accumulate species compared to logs in the mature log-class when considered in relation to the cumulative mean surface area (Figure 9c) or volume (Figure 9d) of the logs sampled.

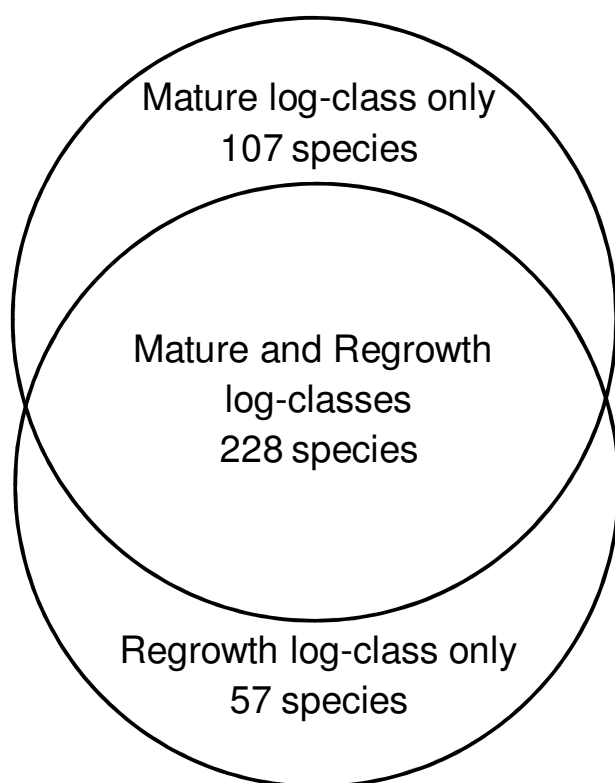


Figure 8. Venn diagram illustrating the degree of overlap of overlap in species occurrence in the saproxylic beetle fauna detected in the mature and regrowth log-classes, based on Data-set 2.

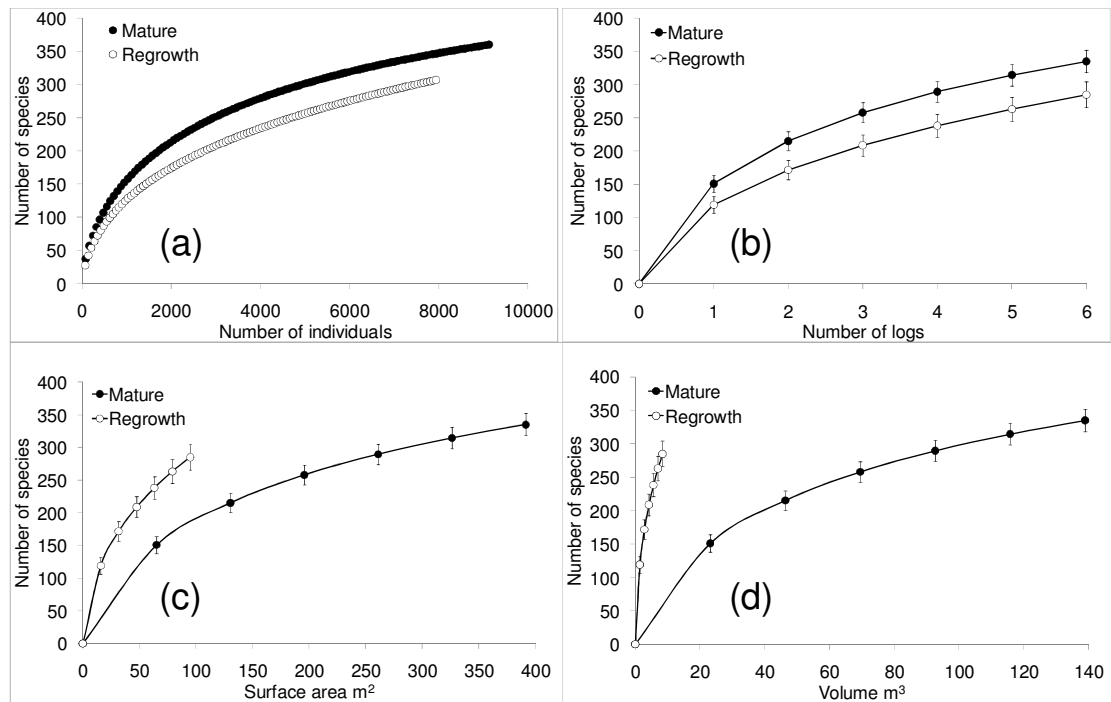


Figure 9. Accumulation of saproxylic beetle species with increasing numbers of (a) individuals, (b) logs, (c) log surface area, and (d) log volume, presented by log-class. Figure 2a depicts individual-based Coleman rarefaction curves, based on sample-series-level data from Data-set 1. Standard deviations were computed but are not shown since they were always very small in comparison to the differences between log-classes and would have been obscured by the circle symbols. Figures 2b-d depict Mao-Tau interpolations of species density with 95% confidence intervals, based on Data-set 2. The surface-area and volume increments applied in Figures 2c and 2d respectively are based on mean values per log for the log-class in question. These gross differences in species density carried through into clear differences in assemblage composition. At the level of individual logs and with data from Data-set 2 pooled across all available sample-series, assemblage composition showed greater similarities among members of a given log-class than between log-classes (Figure 10), with the exception of log M1, which appeared to be an outlier in this analysis. Within a given log-class, members of log-pairs (i.e. those sharing the same felling date) did not show any greater similarities to each other than to other logs in the same log-class. An MRPP analysis based on the same data-set determined that assemblage composition of saproxylic species differed significantly between the two log-classes ( $p < 0.005$ ).

Separate one-way ANOVAs at the log level, conducted for each of the 30 most numerous species in Data-set 2, determined that only a single species differed significantly in abundance between the two log-classes: Aleocharinae TFIC sp 066 ( $F_1 = 9.811$ ,  $p = 0.007$ ), which was more numerous in the regrowth log-class. An indicator species analysis conducted on eclector-level data, lumped across all available sample series in Data-set 2, found four species to be significantly ( $P < 0.05$ ) and strongly ( $IV > 50$ ) affiliated with the mature log-class: *Sphaerotherax tasmani* ( $IV = 83$ ;  $p = 0.003$ ); *Decilaus bryophilus* ( $IV = 67.6$ ;  $p = 0.005$ ); *Horaeomorphus* TFIC sp 12 ( $IV = 76.9$ ;  $p = 0.025$ ) and *Dohrnia simplex* ( $IV = 81$ ;  $p = 0.038$ ).

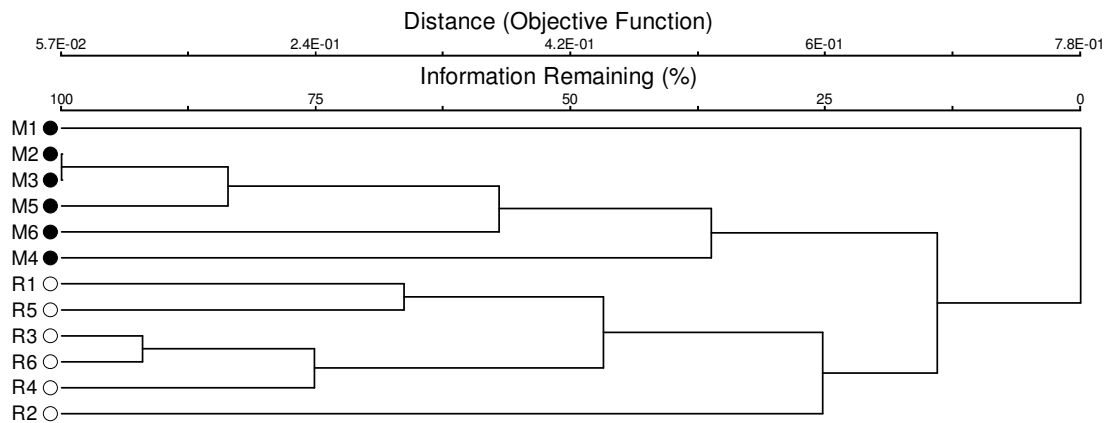


Figure 10. Output of a hierarchical cluster analysis of log-level saproxylic beetle assemblages, based on Data-set 2. The scale has been log-transformed for greater clarity. Closed circles indicate logs in the mature log-class; open circles indicate logs in the regrowth log-class.

A further two species were affiliated with the regrowth log-class: Aleocharinae TFIC sp 066 (IV = 83.1;  $p = 0.005$ ) and *Porrostoma rhipidium* (IV = 74.3;  $p = 0.037$ ). Another indicator species analysis, this time conducted on log-level data for Data-set 3, for which three replicates of each group were included, found a largely different set of species as affiliates. For the mature log-class, the six species were: *Baeocera* TFIC sp 02 (IV = 100;  $p = 0.006$ ); *Horaeomorphus* TFIC sp 12 (IV = 100;  $p = 0.006$ ); *Zeadolopus* TFIC sp 02 (IV = 78.9;  $p = 0.036$ ); *Lissotes subcaeruleus* (IV = 80;  $p = 0.041$ ) and *Exithius* TFIC sp 02 (IV = 80;  $p = 0.045$ ). For the regrowth log-class, the three species were: Aleocharinae TFIC sp 066 (IV = 86;  $p = 0.006$ ); *Anepius koebeli* (IV = 80;  $p = 0.046$ ) and *Quedius baldiensis* (IV = 80;  $p = 0.046$ ).

#### *Faunal succession (independent of log-class)*

The strong seasonality patterns observable in the fauna overall are also evident at the level of Cycle (Figure 11). In addition to month-by-month changes in assemblage composition in a manner reflective of a yearly cycle, it is evident that the two Cycles differ in their assemblage composition. In Data-set 1, more individual beetles (12487: 73% of the total) and species (289) were captured in Cycle 1 than in Cycle 2, where the corresponding figures were 5107 beetles (27% of the total) and 253 species (but note that in Data-set 1, Cycle 1 comprised more samples than Cycle 2). Cycles 1 and 2 shared 189 species. Most species occurred too infrequently and were not sufficiently numerous to explore changes in their abundance over the course of the study. However, most of the 20 most numerous species from Data-set 2 showed inter-annual trends overlaid on strong seasonality patterns (Figure 12). For example, *Hymaea succinifera* (Phloeostichidae), *Trechimorphus diemenensis* (Carabidae) and *Decilaus bryophilus* (Curculionidae) showed a progressive decline over the course of the study, while *Chylnus ater* (Carabidae) and *Atheta* TFIC sp 01 (Staphylinidae) showed progressive increases, and *Platypus subgranosus* (Curculionidae) and *Hadrobregmus areolicolle* (Anobiidae) peaked in abundance in Years 2 and 3 respectively.

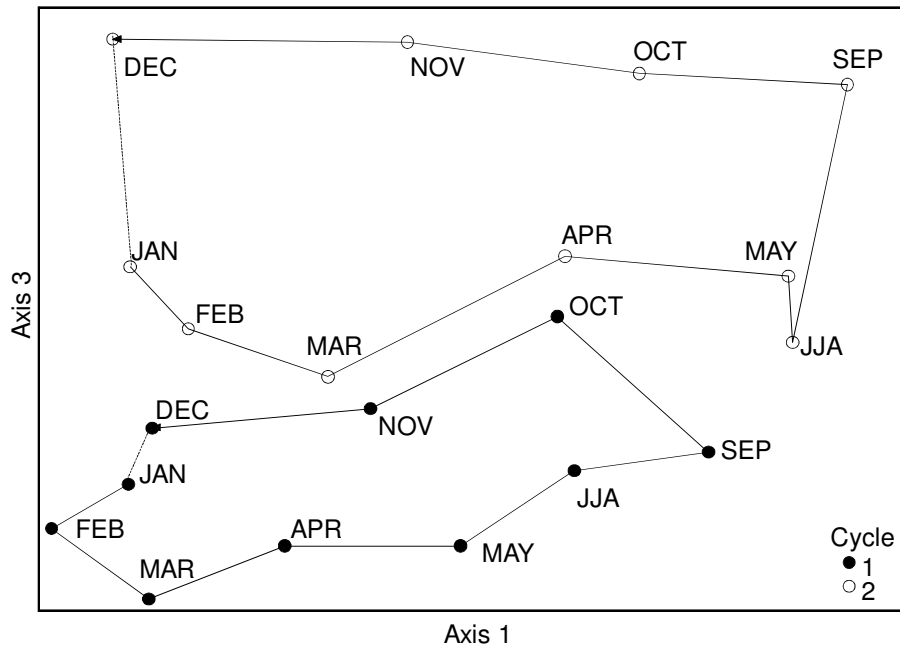


Figure 11. Output from non-metric multidimensional scaling of cycle-level saproxylic beetle assemblages by month of sampling, based on Data-set 4, but lacking singletons and with the winter months merged (JJA). Two axes of a 3-dimensional solution shown (STRESS = 6.80). Closed circles indicate Cycle 1; open circles indicate Cycle 2. Arrows connect consecutive months (in the conventional sense, starting with JAN and ending with DEC) within the same Cycle.

An indicator species analysis, based on eclector-level data from Data-set 2 for Years 1 and 7 only (representing the two extremes of time with sufficient numbers of replicates to perform the analysis), found six species to be significantly ( $P < 0.05$ ) and strongly ( $IV > 50$ ) affiliated with the Year-1 samples: *Dohrnia simplex* (Oedemeridae:  $IV = 62.7$ ;  $p = 0.0002$ ); *Exithius capucinus* (Curculionidae:  $IV = 54.3$ ;  $p = 0.0002$ ); *Hymaea succinifera* (Phloeostichidae:  $IV = 82.8$ ;  $p = 0.0002$ ); *Macrohyliota bicolor* (Uleiotidae:  $IV = 68.3$ ;  $p = 0.0002$ ); *Sphaerotherax tasmani* (Clambidae:  $IV = 68.5$ ;  $p = 0.0002$ ) and Aleocharinae TFIC sp 066 (Staphylinidae:  $IV = 65.5$ ;  $p = 0.0004$ ). Two species were affiliated with the Year-7 samples: *Atheta* TFIC sp 01 (Staphylinidae:  $IV = 55.5$ ;  $p = 0.0016$ ) and *Quedius sidneensis* (Staphylinidae:  $IV = 58.5$ ;  $p = 0.01$ ).

The proportion of functionally flightless species and individuals (from Data-set 2) varied year-by-year, but increased towards the end of the study, from 20% and 17% for both variables in Years 0 and 6 respectively to 29% and 30% respectively in Year 8 (Figure 13a). From the same data-set, the proportion of obligately saproxylic species and individuals showed a progressive decrease, down from 53% and 63% respectively at the start to 45% and 37% respectively by the end of the study (Figure 13b). The proportions of species in the different larval feeding guilds remained relatively stable over the course of the study, though predators became more prominent in Years 5 and 6 (Figure 13). The proportions of individuals varied more widely (Figure 13d). In particular, the proportion of wood-feeders peaked in Year 4, while the proportion of predators peaked in Year 5, apparently at the expense of the other three feeding guilds, and remained elevated thereafter.

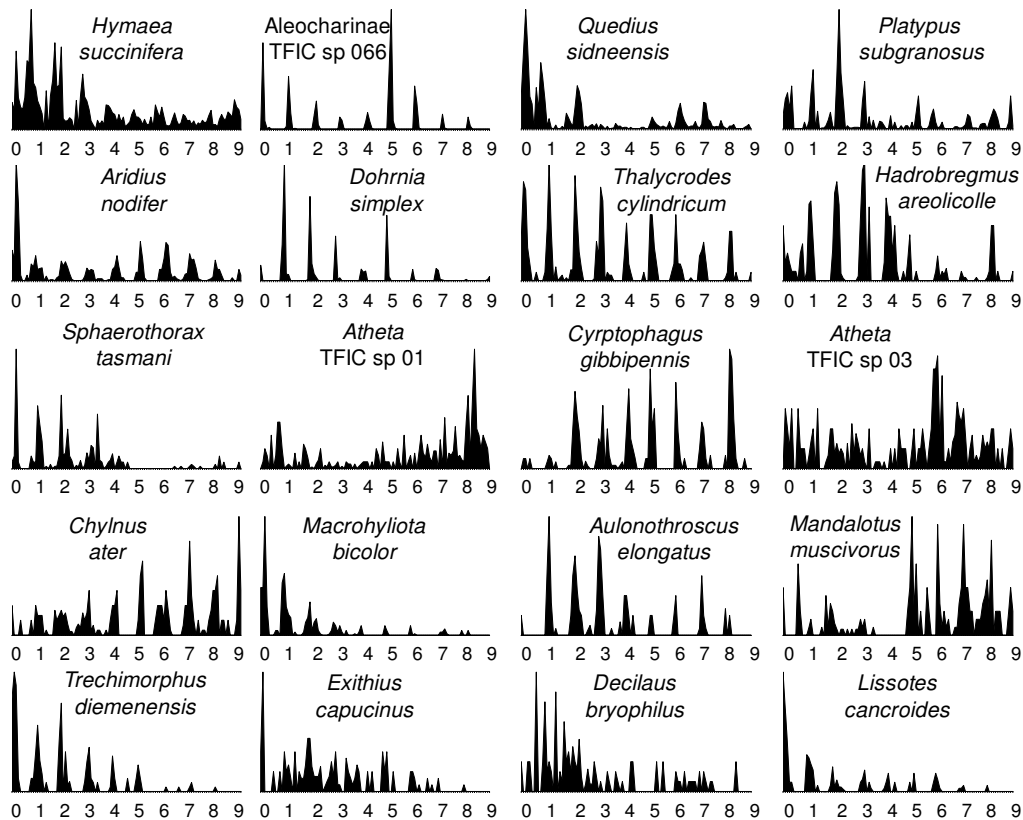


Figure 12. Monthly catches of the 20 most numerous beetle species over the entire study-period, based on Data-set 2 and presented in order of decreasing abundance. The vertical axes have been relativised so as to optimally display abundance values appropriate for each species. Because of differences in sampling intensities in different years (Table 2), some months represent averages across multiple logsections.

#### *Combined influences of log-class and time on the fauna*

For Data-set 1, over the course of the 117 monthly sample series, the rate of species accumulation (collectors' curve) of saproxylic species at the level of log-class was initially steep, but fluctuated and gradually declined over time; the mature log-class consistently accrued more species than the regrowth log-class (Figure 14). For the regrowth log-class, an asymptote was reached after 107 sample series, but no asymptote was reached for the mature log-class, since the last sample yielded a single additional species. For saproxylic beetles in Data-set 2, there was a trend for a progressive and statistically significant ( $p < 0.05$ ) decrease in mean numbers of both individuals (Figure 15) and species (Figure 16) over the first five years (i.e. over the course of Cycle 1). At the start of Cycle 2, mean numbers of species were higher again for the regrowth log-class, while subsequent years demonstrate another statistically significant decrease. This trend was less evident for the mature log-class and for the number of individuals in either log-class. For any given year, there was a tendency for the mean number of individuals to be slightly higher for the mature log-class than for the regrowth log-class in Cycle 1, and for the reverse situation in Cycle 2. However, none of these differences were statistically significant. For species density, there was a more pronounced tendency for greater mean numbers of species in the mature log-class compared to the regrowth log-class; however, these differences were only statistically significant ( $p < 0.05$ ) in Years 0 and 4.

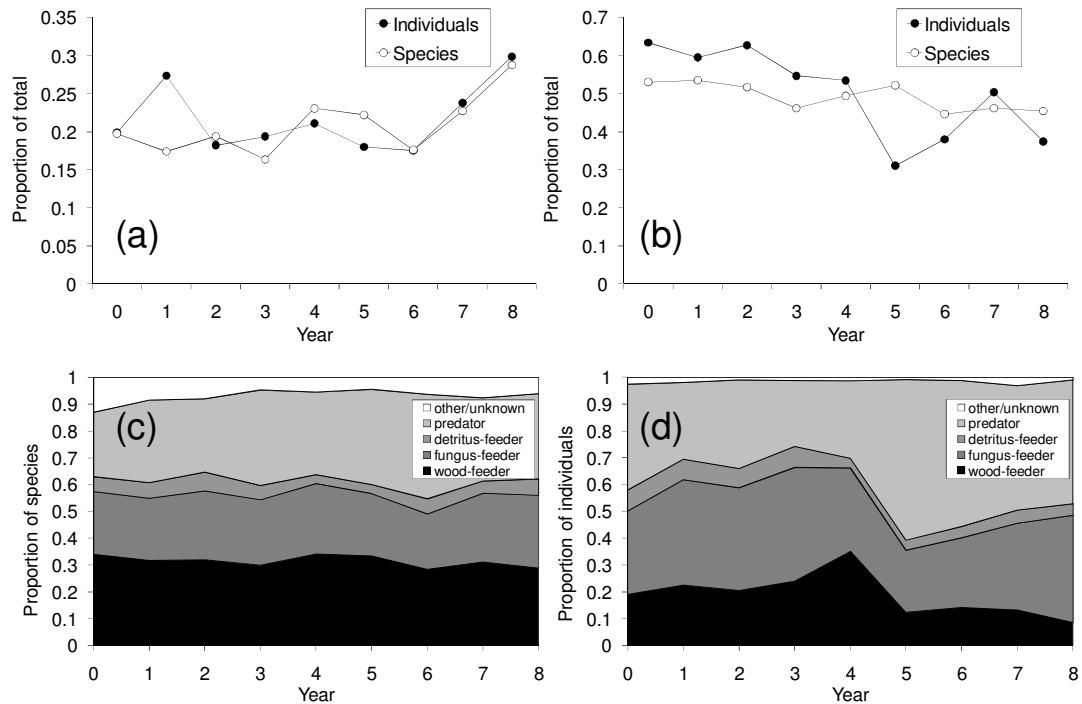


Figure 13. Year-by-year variation in the proportions of saproxylic beetles allocated to different categories, based on Data-set 2: (a) functionally flightless (as opposed to winged) species (open circles) and individuals (closed circles) that were from; (b) obligately saproxylic species (open circles) and individuals; (c) breakdown of species by larval feeding guilds; and (d) breakdown of individuals by larval feeding guilds.

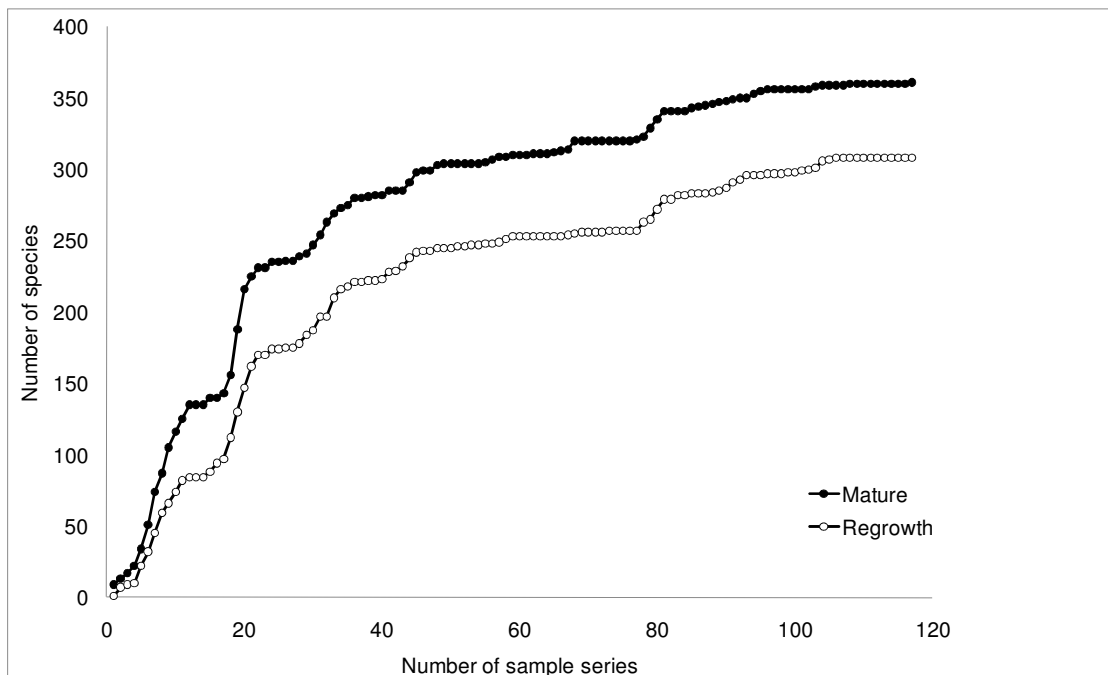


Figure 14. Log-class-level saproxylic beetle species accumulation curves (collectors' curves) for the 117 sequential monthly sample-series, based on Data-set 1. Closed circles indicate logs in the mature log-class; open circles indicate logs in the regrowth log-class.

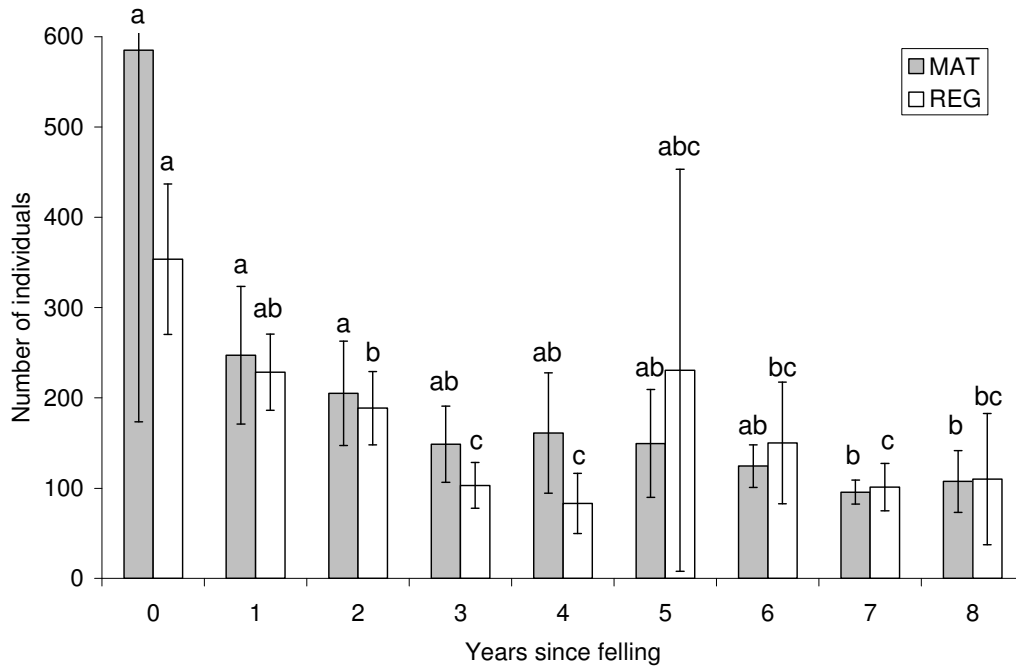


Figure 15. Mean number of saproxylic beetle individuals (+ 95% C.I.) per year-since-felling, based on Data-set 2. Note that different years are represented by different numbers of eclector-groups (Table 2). For each log-class independently, letters a-c denote membership of groups differing significantly ( $p < 0.05$ ) in mean numbers of individuals.

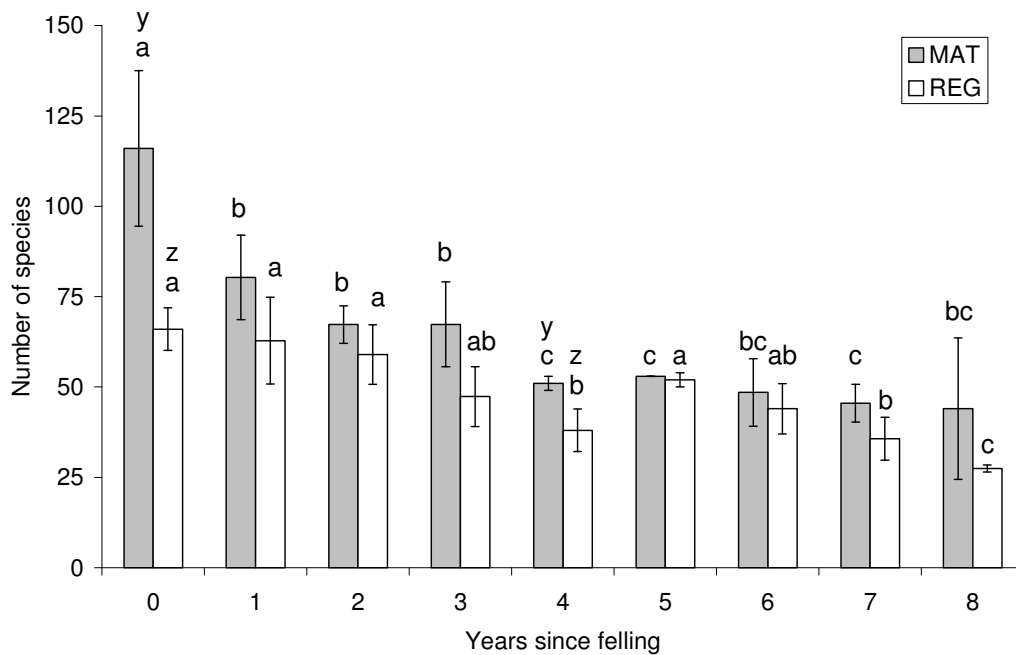


Figure 16. Mean number of saproxylic beetle species (+ 95% C.I.) per year-since-felling, based on Data-set 2. Note that different years are represented by different numbers of eclector-groups (Table 2). For each log-class independently, letters a-c denote membership of groups differing significantly ( $P < 0.05$ ) in mean numbers of species. For comparisons between log-classes in a given year, letters y-z denote equivalently significant differences.

Output from an NMS ordination on the saproxylic beetles from log-level data by Cycle in Data-set 1 (Figure 17) demonstrates a strong separation in assemblage composition between the two Cycles, with a similar trajectory of change for nearly all logs, regardless of their log-class. The output also demonstrates that assemblages in Cycle 1 tended to differ by log-class, with these differences being largely maintained into Cycle 2. A non-parametric multivariate ANOVA on the same data-set determined that assemblage composition of saproxylic species differed significantly between the two log-classes ( $F_{1,11} = 2.612$ ;  $p < 0.005$ ) as well as between the two Cycles ( $F_{1,11} = 6.56$ ;  $p < 0.001$ ). The interaction between the two factors was not statistically significant.

Separate indicator species analyses for each year-since-felling (Table 3) in Data-set 2 demonstrated that at various points during the entire study-period there were a total of ten species affiliated with either the mature or the regrowth log-class. No species showed significant affiliations across all years, but neither was there much evidence of species showing strong successional patterns within a log-class (for instance, by showing significant affiliations with the same log-class over consecutive years). Five of the seven species affiliated with the mature log-class were considered to be obligately saproxylic, while only one of the three species affiliated with the regrowth log-class was obligately saproxylic. All but two of these species were considered capable of flight. The two exceptions were the functionally flightless *Chylnus ater* and *Hymaea succinifera*, both of which were affiliated with the mature log-class.

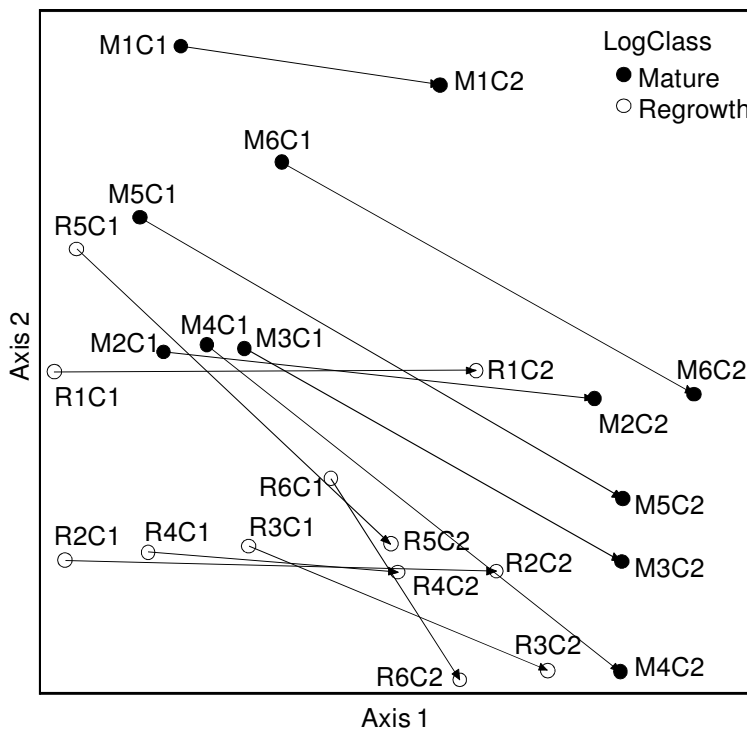


Figure 17. Output from non-metric multidimensional scaling of log-level saproxylic beetle assemblages, at two different time-periods (corresponding to Cycles 1 and 2), based on Data-set 1, but lacking singletons. Axes 1 and 2 of a 3-dimensional solution shown (STRESS = 11.06). Closed circles indicate logs in the mature log-class; open circles indicate logs in the regrowth log-class. Arrows connect the same logs through time.

Table 3. Indicator Species Analysis statistics for species showing significant ( $P < 0.05$ ) and strong ( $IV > 0.5$ ) affiliations with either the mature or the regrowth log-class within particular years-since-felling, based on Data-set 2. Separate analyses were conducted for each year, with different years differing in the level of available replication. Status:  $Sx^+$  - facultatively saproxylic;  $Sx^{++}$  - obligately saproxylic;  $F^-$  - functionally flightless;  $F^+$  - winged and presumed capable of flight.

	Status	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
<b>Affiliated with mature</b>									
<i>Atheta</i> TFIC sp 03	$Sx^+, F^+$	-	-	-	-	-	-	-	IV = 68.2 p = 0.047
<i>Chylnus ater</i>	$Sx^{++}, F^-$	IV = 76.7 p = 0.018	-	-	-	-	-	-	IV = 89.5 p = 0.020
<i>Decilaus bryophilus</i>	$Sx^{++}, F^+$	-	IV = 73.5 p = 0.046	-	-	-	-	-	-
<i>Dohrnia simplex</i>	$Sx^{++}, F^+$	IV = 76.3 p = 0.045	-	-	IV = 88.3 p = 0.011	-	-	-	-
<i>Hadrobregmus areolicolle</i>	$Sx^{++}, F^+$	-	-	IV = 92.9 p = 0.019	IV = 97.6 p = 0.003	-	-	-	-
<i>Hymaea succinifera</i>	$Sx^{++}, F^-$	-	-	IV = 68.4 p = 0.026	-	-	-	-	-
<i>Sphaerothorax tasmani</i>	$Sx^+, F^+$	IV = 86.4 p = 0.005	-	IV = 84.9 p = 0.009	-	-	-	-	-
<b>Affiliated with regrowth</b>									
Aleocharinae TFIC sp 066	$Sx^+, F^+$	IV = 92.6 p = 0.018	IV = 77 p = 0.03	IV = 91.1 p = 0.002	-	-	IV = 82.9 p = 0.045	IV = 89.7 p = 0.026	-
<i>Quedius sidneensis</i>	$Sx^{++}, F^+$	-	IV = 76.7 p = 0.041	-	-	-	IV = 71.9 p = 0.041	-	-
<i>Thalycrodes cylindricum</i>	$Sx^+, F^+$	-	-	-	-	IV = 80 p = 0.023	-	-	-

Figure 18 shows the output of an ordination of eclector-level data from Data-set 2, and demonstrates a weak relationship between time-since-felling and assemblage composition (roughly corresponding to Axis 2) at this level of detail. Also demonstrated is some difference between the two log-classes (roughly along Axis 1), although with much overlap. A clearer picture emerges when data from Data-set 3 are considered at the log-class level (Figure 19). In this representation, the trajectory of change in assemblage composition over time is more-or-less unidirectional, but the two log-classes track parallel courses, maintaining roughly equal levels of distinctiveness at each time-step.

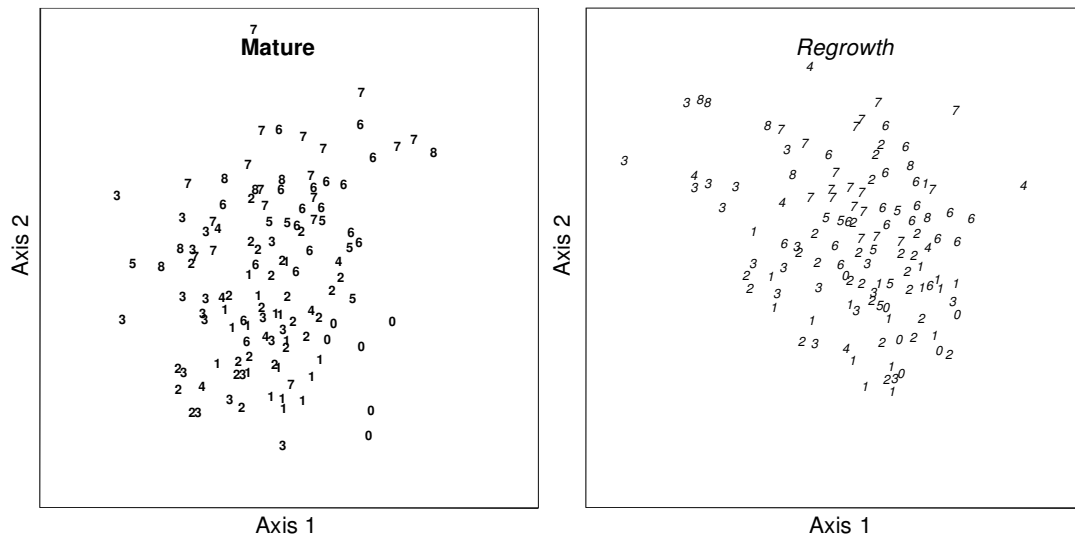


Figure 18. Output from non-metric multidimensional scaling of eclector-level saproxylic beetle assemblages, at nine different time-periods (corresponding to Years 0 to 8) based on Data-set 2, but lacking singletons. Axes 1 and 2 of a 3-dimensional solution shown (STRESS = 13.09). Both charts show the same ordination space, but for clarity, only points from the mature log-class are shown on the left-hand plot, while only points from the regrowth log-class are shown on the right-hand plot.

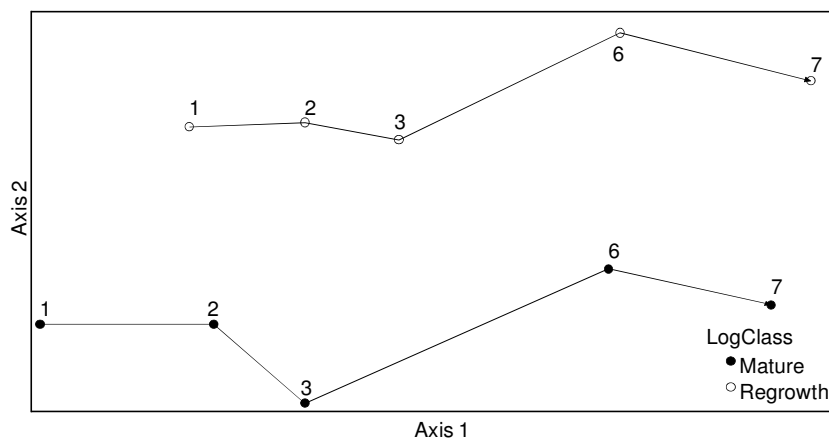


Figure 19. Output from non-metric multidimensional scaling of log-class-level saproxylic beetle assemblages based on Data-set 3, but lacking singletons. Both axes of a 2-dimensional solution shown (STRESS = 6.69). Closed circles indicate logs in the mature log-class; open circles indicate logs in the regrowth log-class. Arrows connect the same log-classes through time.

From Figure 20, which illustrates the output of separate ordinations on different subsets of Data-set 3, it appears that both common and rare species contribute to the changes in assemblage composition with time, and to the separation of log-classes; in each case, the commoner species seem to exert slightly more influence on the strength of these patterns than the rarer ones. Excluding all but the 30 most numerous species and re-running the ordination retained much of the difference between the two log-classes, as well as the clear trajectory of change over time (Figure 20a). Excluding these 30 most numerous species also retained much of these differences (Figure 20b). The patterns were a little less clear when excluding all but the species ranked 31-100 in abundance (Figure 20c), while excluding the 100 most numerous species (Figure 20d) also led to a somewhat less distinct pattern.

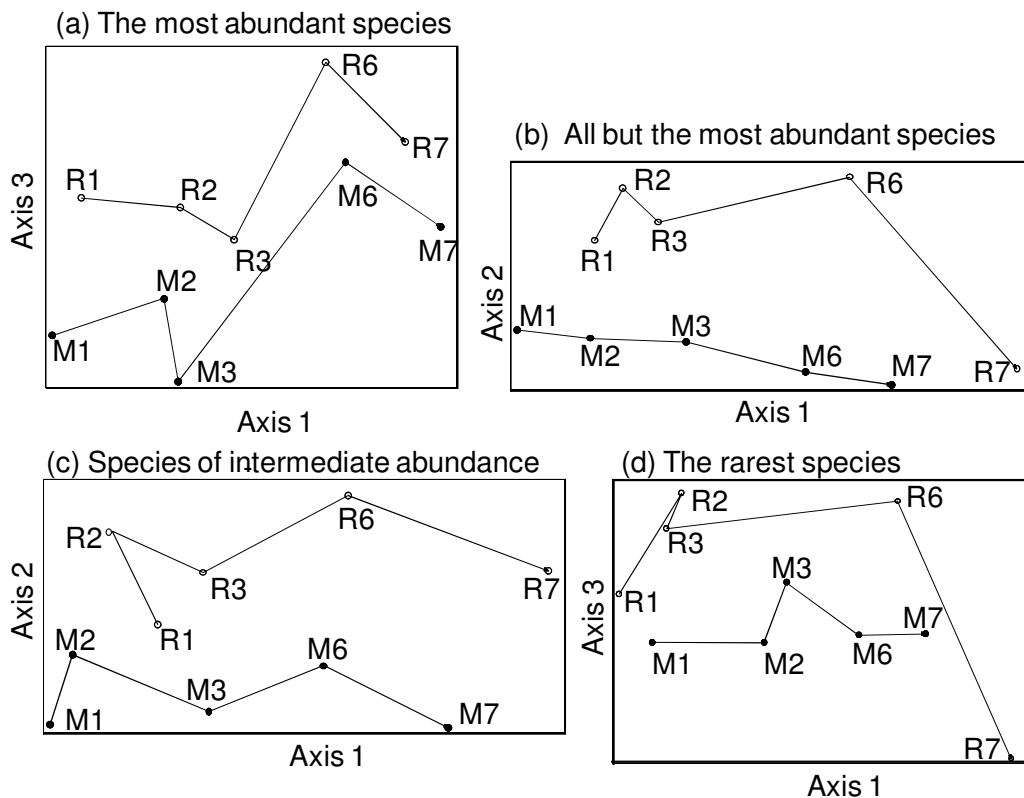


Figure 20. Outputs from four non-metric multidimensional scalings of log-class-level saproxylic beetle assemblages based on Data-set 4, but lacking singletons. Closed circles indicate logs in the mature log-class; open circles indicate logs in the regrowth log-class. Arrows connect the same log-classes through time. (a) the most abundant species: all but the 30 most numerous species were excluded; two axes of a 3-dimensional solution shown (STRESS = 2.16); (b) all but the most abundant species: the 30 most numerous species were excluded (leaving 227 species); both axes of a 2-dimensional solution shown (STRESS = 6.95). (c) species of intermediate abundance: all but the species 31 to 100 were excluded (leaving 70 species); both axes of a 2-dimensional solution shown (STRESS = 7.10); (d) the rarest species: the 100 most numerous species were excluded (leaving 157 species); two axes of a 3-dimensional solution shown (STRESS = 2.77).

In a similar vein, it is apparent from Figures 21 and 22 that many component parts of the overall assemblage share the overall relationships with time-since-felling, and to a lesser extent with log-class. The patterns seem to be equally strong among obligately as among facultatively saproxylic species (Figures 21a and b respectively); and among winged as among functionally flightless species (Figures 21c and d respectively). Among members of different larval feeding guilds (Figure 22), some differences in the strength of the patterns are evident. The time-since-felling patterns are strongest in wood-feeders and fungus-feeders, while the log-class differences are strongest in fungus-feeders and predators.

It should be noted that the ordination for fungus-feeders had to be ‘forced’ to solve in three dimensions, since otherwise the program provided only a single-axis solution (plotted against rank), presumably because the positioning of points in ordination space was not strongly supported statistically in more than a single dimension. Likewise, for detritus-feeders, no degree of multidimensionality produced a statistically significant solution, although the three-axis solution presented here received the most support.

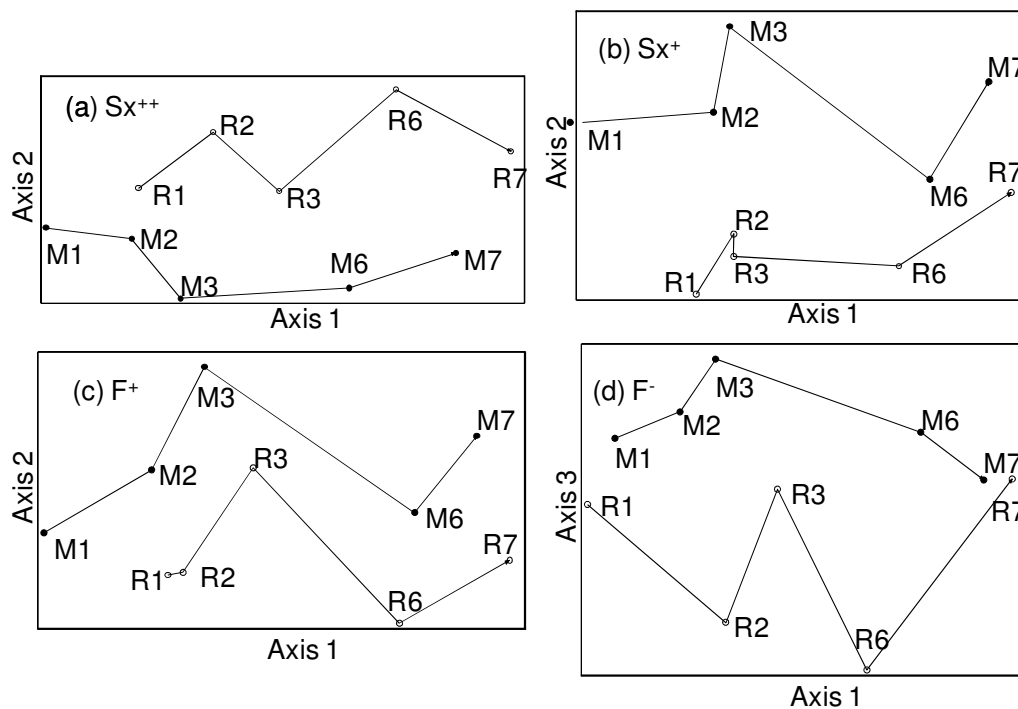


Figure 21. Outputs from four further non-metric multidimensional scalings of log-class-level saproxylic beetle assemblages based on Data-set 3, but lacking singletons. Closed circles indicate logs in the mature log-class; open circles indicate logs in the regrowth log-class. Arrows connect the same log-classes through time. (a) obligately saproxylic species only; both axes of a 2-dimensional solution shown (STRESS = 7.77); (b) facultatively saproxylic species only; both axes of a 2-dimensional solution shown (STRESS = 7.25). (c) winged species only; both axes of a 2-dimensional solution shown (STRESS = 6.26); (d) functionally flightless species only; two axes of a 3-dimensional solution shown (STRESS = 2.73).

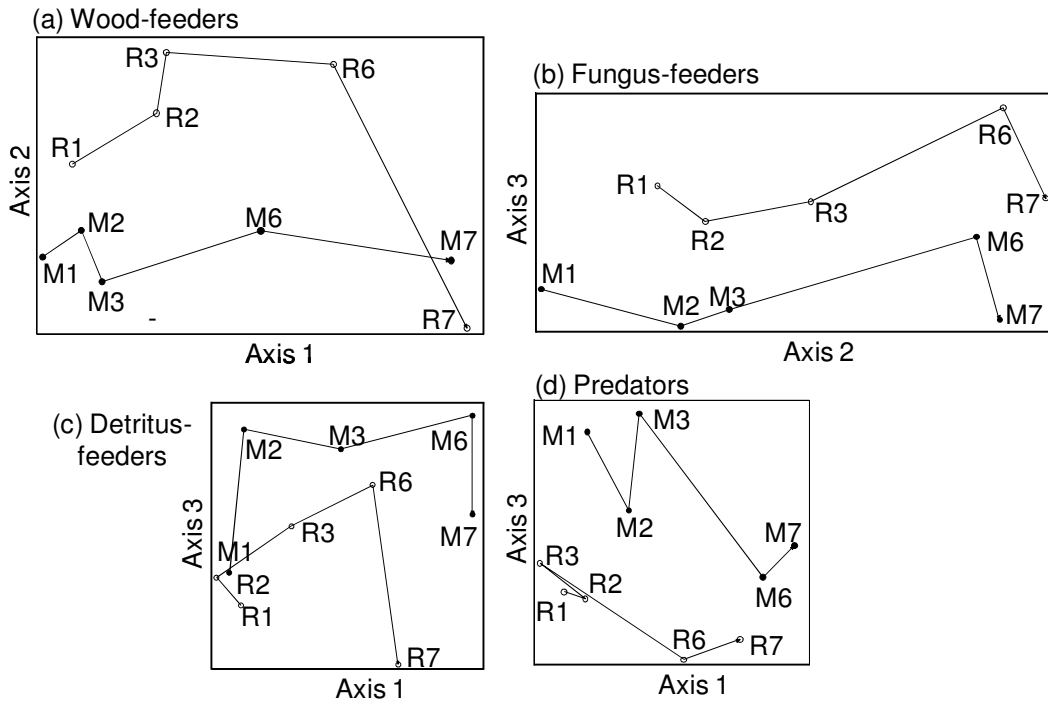


Figure 22. Outputs from four further non-metric multidimensional scalings of log-class-level saproxylic beetle assemblages based on Data-set 4, but lacking singletons. Closed circles indicate logs in the mature log-class; open circles indicate logs in the regrowth log-class. Arrows connect the same log-classes through time. (a) obligately saproxylic species only; both axes of a 2-dimensional solution shown (STRESS = 7.77); (b) facultatively saproxylic species only; both axes of a 2-dimensional solution shown (STRESS = 7.25). (c) winged species only; both axes of a 2-dimensional solution shown (STRESS = 6.26); (d) functionally flightless species only; two axes of a 3-dimensional solution shown (STRESS = 2.73).

## Discussion

In its first decade, the Warra log-decay experiment has provided a wealth of information on the saproxylic beetle fauna of *Eucalyptus obliqua* logs in their early stages of decay. It should be noted, of course, that while the study spanned a whole decade, this is not long in the life of the logs concerned. Furthermore, the study is limited to a small geographical area and to only twelve logs, so its broader applicability remains untested.

### *Species richness and taxonomic composition*

The richness of the saproxylic beetle fauna (453 species from 7194 beetles) appears to equal or surpass what is known about similar faunas in temperate forests elsewhere, although the differences in surface area (487 m<sup>2</sup>) and volume (147 m<sup>3</sup>) sampled in this study, the different sampling techniques and the different temporal extents of sampling preclude direct comparisons. For instance Kappes and Topp (2004) recorded 32,477 beetles of 342 species emerging from just 11 m<sup>3</sup> of mixed oak and beech logs at one study-site in Germany; Schiegg (2001) recorded 4,906 individuals of 228 species emerging from 4.7 m<sup>3</sup> of beech logs in a Swiss study; Lindhe and Lindelow (2004) recorded 47,038 saproxylic beetles of 316 species from a surface area of about 1000 m<sup>2</sup> of Swedish boreal forest high stumps, sampled using eclectors; Johansson *et al.* (2007) recorded 30,611 saproxylic beetles of 240 species from eclectors enclosing about 20 m<sup>2</sup> of spruce logs over the space of a year; Ulyshen and Hanula (2010) recorded 10,506 beetles of 209 species emerging from 12 loblolly pine logs; and Hammond (1997) found 257 species (excluding aleocharine staphylinids) from three years' sampling of aspen logs in Canadian boreal forest.

Few species were common and most species were rare. Singletons comprised about a quarter of all species, while just four species (two wood-feeders and two predators) comprised two-fifths of all the individuals. This gross disparity in species' abundances is a very common pattern in insect faunas. It is most often discussed in relation to highly speciose tropical faunas (Janzen, 1973; Wolda, 1992; Price *et al.*, 1995; Novotný and Basset, 2000), but it appears to be equally a feature of the temperate Tasmanian fauna in this study. In a study of leaf-feeding insects in New Guinea, Novotný and Basset (2000) found that the proportion of singletons in their samples decreased with the total number of individuals sampled, but very slowly – for the one fig species analysed in this way, the rate of decrease was proportional to the logarithm of the number of individuals, such that they estimated that they would have had to sample about 180,000 insects to eliminate all occurrences of singletons. Clearly this level of sampling would have been very difficult to achieve in the present study.

In terms of its taxonomic composition, the Warra fauna demonstrates the typical dominance of staphylinids and curculionids – two of the largest beetle families (indeed animal families) in the world. In the study of Kappes and Topp, (004), 115 of the 342 species were staphylinids, although only 11 were curculionids. The Warra fauna does stand out as markedly different compared to the better-studied temperate northern-hemisphere faunas in terms of its high numbers of co-occurring saproxylic scirtid and lucanid species. For instance, while this study found 12 co-occurring scirtid and 5 lucanid species, neither scirtids nor lucanids appeared in the extensive lists of species in the studies of Ulyshen and Hanula (2010) in the United States or Kappes and Topp (2004) in Germany. The Warra fauna also hosts members of the

families Hobartiidae and Boganiidae that are only known from the temperate zones of the southern hemisphere (Lawrence and Britton, 1994).

The Warra fauna also stands out as being very poorly described taxonomically, compared to most published studies. Whereas about half of all species were apparently undescribed, the proportion of undescribed species in the European fauna is unlikely to exceed one or two per cent, although the proportion is probably much higher in Canada, where – as in Australia - many beetle families are in need of major taxonomic overhauls (Langor *et al.*, 2008). There are few available datasets to put the Warra proportion in an Australian context. In a study of tropical rainforest beetles in NE Queensland (Stork *et al.*, 2008), just under two-fifths of the beetle species collected were undescribed – a proportion that the authors considered would rise had their study included all beetle families rather than a selection of the more tractable ones.. Both these figures probably reflect the predominance in the sampled faunas of small, non-phytophagous species which historically have been given less taxonomic attention than large, phytophagous species (Kitching, 2006); they may also reflect both the diversity of Australian insect faunas generally, and a long-standing paucity of available taxonomic expertise in Australia (Yeates *et al.*, 2003).

#### *Trophic structure*

Allocating Tasmanian beetles to particular larval feeding categories is somewhat subjective, because of the poor state of knowledge of the local fauna. Thus analyses based on these allocations should be treated with caution. Nevertheless, some clear trends are apparent. The predominance of predatory species may, on the face of it, suggest a rather unbalanced trophic structure. However, the saproxylic beetle fauna is but one element of the overall fauna inhabiting these logs, which also includes representatives of many other insect orders, other arthropods and other invertebrates. It is likely that many of the predators detected in this study feed not on other beetles but on softer-bodied taxa such as springtails and the larvae of fungus-feeding flies. This is known to be the case, for instance, for many staphylinid and carabid beetles (Lawrence and Britton, 1994), which dominate the list of predatory beetle taxa in this study. Conversely, for a wood-based substrate, the logs appear to support rather few wood-feeding beetle species, and proportionally even fewer individuals. However, the logs themselves are subject to decomposition by wood-decay fungi, and the majority of fungus-feeders are likely to be associated with these; many are likely to feed internally on fungal mycelium rather than externally on fruiting-bodies. In any event, the proportions noted in the present study are not atypical. Fungus-feeders were the most species-rich functional group in a Swedish study of early-successional spruce logs (Johansson *et al.*, 2007), while Langor *et al.* (2008) noted that studies of the beetle fauna of aspen wood in both Sweden and Canada had found that species of predators and fungus-feeders numerically dominated the assemblages.

The eclectors experienced little dilution from non-saproxylic taxa. Most individuals of non-saproxylic species sampled are presumed to have been trapped in overwintering- or aestivating- sites when the eclectors were first closed. This is almost certainly the case for the most numerous species in this category, the eucalypt leaf-beetle *Paropsisterna bimaculata*, which is known to overwinter amongst fissured bark as well as under logs (Clarke *et al.*, 1998).

Eucalypts are unusual, in temperate forest terms, in tending to host very few bark-beetles (notwithstanding the occurrence in this study of two feral species). It is possible that their near-absence from early-successional eucalypt logs may lead to different decompositional pathways and different opportunities for colonisation of logs by other taxa, compared to logs of tree species in which bark-beetles are prominent. Nevertheless, when considered by larval feeding guild, the fauna in the present study showed an equivalent decrease in wood-feeders and a corresponding increase in predators, much as occurs in systems in which bark-beetles are prominent. For instance, in a U.S. study of emergence of saproxylic beetles from loblolly pine logs between zero and nine years old, phloem-associated species (such as bark-beetles, wood-borers and their predators) were prominent as associates of young logs, while fungus-feeders and their predators were more associated with old logs. In a Swedish study of saproxylic beetle assemblages on beech snags (Brunet and Isacson, 2009), species associated with fresh wood (such as bark-beetles) showed significant decreases from decay-class 1 to 4, while rot-hole-associated species showed significant increases, and fungicolous and decayed-wood-associated species showed peaks in richness in decay-class 3 followed by a trough in decay-class 4. In the German study of Kappes and Topp (2004) the fauna of oak and beech logs in the first six years of decomposition was dominated by generalist predators, but in terms of numbers of individuals, it was dominated by bark-beetles. In a Canadian study of saproxylic beetles and other arthropods emerging from pine logs across the full spectrum of four decay-classes (Vanderwel *et al.*, 2006), each decay-class had a characteristic fauna at the family level. Between the first and second decay-classes, the average rank-abundance of predatory and wood-feeding families decreased significantly, while fungus-feeders increased (although not significantly so). In another Canadian study of saproxylic beetles from spruce and aspen snags across the full spectrum of four decay-classes (Saint-Germain *et al.*, 2007), many individual species demonstrated strong preferences for wood of a particular density-range, with density itself being inversely related to decay-class.

#### *Life-histories*

The present study does not allow detailed consideration of beetles' rate of reproduction and length of life-cycle, which remain unknown for most local species. However, it does allow some consideration of beetles' dispersal ability, since it was possible to categorise species by their flightedness. Overall, winged species dominated the assemblages: they greatly outnumbered functionally flightless species; most of the more numerous species were winged; and functionally flightless species were represented by proportionally fewer individuals overall (though paradoxically the most numerous species overall was functionally flightless). A predominance of putative r-strategists (Pianka, 1970) fits with the early decompositional state of the logs, and perhaps reflects the rapidly changing nature of the log substrate.

However, the study offers some evidence for the idea that the representation of flightlessness in beetle assemblages should increase with decomposition. Over the final two years of the study, there was a decrease in the proportion of winged species and individuals at the expense of functionally flightless species. In the first year of the study, functionally flightless species only made up 20% of the individuals and species, but by the final year, the proportion of individuals had increased to 29% while the proportion of species had increased to 30%. Amongst the most numerous species at least, there was some evidence for winged species (such as *Quedius*

*sidneensis*) to show a greater tendency to be more numerous at the start of the study than at the end of it, and for functionally flightless species (such as *Chylinus ater* and *Mandalotus muscivorus*) to show the opposite trend. There were, however, many exceptions to this pattern, such as the increasing prevalence over time for the winged *Atheta* TFIC sp 01 and *Atheta* TFIC sp 03, and the decreasing prevalence over time for the functionally flightless *Decilaus bryophilus* and *Hymaea succinifera*. Perhaps this coexisting mix of species with different dispersal abilities reflects the nature of the surrounding forest, whose maturity and disturbance history together allow it to continuously support high densities of logs in a range of decompositional stages, and thus to support a fauna with dispersal abilities to match. It would be instructive to conduct a similar experiment to the present one in a regrowth-dominated forest, where one would expect an even greater preponderance of flighted versus functionally flightless species.

The nine years of this study also witnessed a steady decrease in the proportion of obligately saproxylic species and individuals at the expense of facultatively saproxylic species (Figure 3). This may perhaps reflect the slow capacity for colonisation by some of the functionally flightless and facultatively saproxylic species, coupled with a shift in the suitability of the logs for occupation by obligately versus facultatively saproxylic species. For instance, wood-feeders (classified as obligately saproxylic) declined, perhaps because many were dependent on bark which was progressively consumed or decomposed; while generalist predators (many classified as facultatively saproxylic) increased, perhaps because of the greater availability of non-beetle prey such as fly larvae associated with wood-decay fungi.

The occurrence of two non-native bark-beetles *Hylastes ater* and *Hylurgus ligniperda* is significant, since both are primarily associated with conifers, both in their native Eurasian range and in their exotic ranges in temperate regions worldwide (Lieutier *et al.*, 2004). While *Hylurgus* is chiefly associated with dead *Pinus* stumps, *Hylastes* also attacks live (usually unhealthy) *Pinus* and *Picea* trees, in the process transmitting wood-rotting fungi, on which the larvae of the next generation feed. In Australia, including Tasmania, both species occur widely in exotic *Pinus radiata* and other coniferous plantations; and in Tasmania in recent years, adults of both species have increasingly been found feeding on the bark of eucalypts planted on sites previously occupied by pines. *Hylurgus* larvae have additionally been found in eucalypt stumps in Tasmania, which suggests that it (and its wood-rotting fungus) has successfully adapted to feeding in eucalypts rather than pines (Dick Bashford, pers. comm.). The nearest pine plantation to Warra is at least 20 km away, and it therefore seems highly likely that both *Hylurgus* and *Hylastes* are now established in *Eucalyptus* logs at Warra, albeit in low numbers. The ecological implications of this recent adaptation have probably not yet played out in full.

#### *Seasonality*

As would be expected for a study-area in a temperate and seasonal climate-zone, different months of the year sampled different combinations of species and different numbers of individuals. The winter months (June to August) were poorest in both species and individuals, and the summer months (December to February) the richest, with spring and autumn intermediate. This pattern of insect activity resembles that of northern Europe (where a summer peak is typical), despite Tasmania lying at a latitude equivalent to that of Mediterranean Europe (where spring and autumn peaks

are more typical - Lieutier and Ghaïoule, 2005; Wikars *et al.*, 2005); western Tasmania's cool-temperate and relatively oceanic climate is the likely reason for this.

A similar seasonality pattern existed in relation to the month of maximum abundance for individual species, and for the month of sole occurrence of the one-third of all species that were only ever detected in a single month. In interpreting these patterns, it is necessary to bear in mind the chronological lumping that monthly sampling entailed, and the fact that the collection of monthly samples didn't often correspond with the end of a particular calendar month to which the sample was allocated in analyses. Nevertheless, had there been a need to restrict sampling to a sub-set of months rather than year-round, the data suggest that the summer months would have been the most informative, and the winter months the least so; yet there is information even in the winter months, as demonstrated by the fact that a handful of species were only recorded then, and they influenced the shape of the 'cycle of the seasons' evident in the ordination plot (Figure 4). While this plot presents the case for a stable seasonal cycle, the timing of the cycle varies among years, as is evident from variations in months of first and mean emergence for individual species (Figure 6). The cause of the change in timing is likely to be climatic. Although species tended to emerge the latest in the coldest year, mean annual maximum temperature does not capture much of the variation in emergence month, which may be due to other, unmeasured climatic factors. Over the decade of the study, the variability in mean annual maximum temperature and in emergence months does not allow identification of a climate-change signal (for instance, a trend for increasingly higher temperatures or early emergence).

Despite the detection of so many species, estimators of species richness predicted the existence of an additional 30-50% more species per log-class. The use of estimators of species richness is fraught with difficulty (Gotelli and Colwell, 2001), and their predictions are often considered to be no more than broad generalisations. Nevertheless, they indicate that insect faunas tend to be both rich and difficult to sample comprehensively, even with such targeted methods as eclectors. Most insect biodiversity studies fail to demonstrate comprehensive sampling of the fauna (e.g. (Novotný and Basset, 2000; Martikainen and Kaila, 2004; Wikars *et al.*, 2005; Dollin *et al.*, 2008; Brunet and Isacsson, 2009b), as in the present study.

#### *Faunal relationships with log-class (independent of time)*

The present study found different assemblages in the two log-classes. Assemblages in the mature log-class comprised consistently more species, including nearly double the number of species unique to this log-class. Among the individual species common enough to allow appropriate analysis, several appeared to be affiliated with the mature log-class, and several with the regrowth log-class. We know so little about the local beetle fauna that it is fruitless to consider why individual species showed such affiliations. For instance, it is unclear why analyses at different levels (log-section, log) gave rise to different suites of indicator species, with only one species, Aleocharinae TFIC sp 066, appearing in the list of affiliates across several different analyses (as an affiliate of the regrowth log-class). The fact that soothe two log-classes differed in this way suggests that they are ecologically distinct, perhaps by nature of differences in the maturity of the trees from which they were derived. It is noteworthy that a higher proportion of species affiliated with the mature log-class in particular years were obligately saproxylic and a higher proportion were functionally

flightless. These traits are those expected of specialists of stable and abundant habitats – see the discussion in Grove and Forster, this issue.

Overall, the observed patterns are consistent with predictions that logs in the mature class would support a richer, more specialised saproxylic beetle fauna. Many studies supporting this contention are summarised in (Grove, 2002a). More recently, a study of saproxylic beetles in Tasmanian *E. obliqua* logs at an intermediate decay-stage (i.e. several decades further into their decomposition than the logs in the present study) found many species to be specialists of logs derived from mature trees, where they appeared to be associated with brown rots in inner heartwood and included genera such as *Prostomis*, *Cossonus*, *Dryophthorus* and *Pycnomerus*, which are considered elsewhere to be poor dispersers vulnerable to the effects of forestry (Yee *et al.*, 2006). (Wardlaw *et al.*, 2009) suggest that logs derived from mature trees owe their value for saproxylic beetles and fungi partly to their connection through time from the old trees that generated them, and present data from two Tasmanian studies showing that mature-aged trees support more fungal and beetle species, and more unique species, than intermediate-aged or young trees. The present study would seem to bear this suggestion out, although the internal condition of the logs has not yet been studied.

While the mature log-class produced more species than the regrowth log-class for a given number of *individuals* and for a given number of *logs*, the regrowth log-class appeared the richer in species when considered in relation to the *surface area* and *volume* of those logs. The surface-area effect is similar to that described for saproxylic beetles and *E. obliqua* trees by Harrison (2007), though the volume effect is the reverse of that study. In the present study, one explanation for lower rates of species accumulation for the mature log-class when considered by volume or surface area might be that, because the eclectors on the regrowth logs were smaller, they were more ‘saturated’ with collecting-heads than were the larger eclectors on logs from the mature log-class, hence allowing a higher proportion of the resident beetle fauna to be collected. But it is also possible that logs from the mature log-class are less productive (per unit surface-area or volume) than regrowth logs, for instance because of their higher level of rot-resistant extractives, or perhaps because they already underwent the most productive stage of internal decay while still standing (Wardlaw *et al.*, 2009). Either reason could account for the lower capture rate of individuals in logs from the mature log-class. The higher number of species for a given number of individuals in logs from the mature log-class and the higher overall species richness could be a consequence of a greater range of specialised microhabitats being present in these logs, making for a higher level of species-packing.

Heilmann-Clausen and Christensen (2004) also explored the surface-area and volume effect in more detail for fungi in beech logs in Denmark, and explained the more rapid rise in species density for a given surface-area or volume of small-diameter logs compared to large-diameter logs partly in terms of their representing a greater number of individual sample-units, with a correspondingly higher level of variation in environmental conditions. In a study of saproxylic flies and beetles emerging from beech logs in Switzerland, (Schiegg, 2001) found a significant positive relationship between volume sampled and species density, but not between surface area and species density. In a study of oak and beech logs in Germany, Kappes and Topp (2004) considered logs in three diameter-classes, and found significantly more saproxylic beetle species in logs of an intermediate diameter (15-21 cm) compared to

small-diameter (5-7 cm) or large-diameter (40-60 cm) logs. This effect was overlaid on a correlation between a sampled log's surface area and its species density. Only a trivial diameter effect was found in a Swedish study of saproxylic beetles and logging residues, although in this study the diameter under investigation only spanned 1-15 cm (Jonsell *et al.*, 2007), and hence all pieces had a much larger surface-area-to-volume ratio than logs in the present study.

In a study of saproxylic beetles in beech snags in Sweden, Brunet and Isacson (2009a) found that snag diameter was of minor importance in determining assemblage composition, but recognised that this might have been because all their snags could be considered 'large-diameter' (> 51 cm). In contrast, Hammond *et al.* (2004) reported a pattern of increasing expected species richness of saproxylic beetles with increasing diameter of aspen snags in a Canadian study, with more species affiliated to the larger-diameter snags than to the smaller-diameter ones, resulting in differentiation in assemblage composition. Grove (2002b) provides a tropical Australian case-study where tree basal area (linked to the prevalence of large-diameter trees) proved to be a good surrogate for saproxylic beetle species richness.

#### *Faunal succession (independent of log-class)*

Cycles 1 and 2 clearly have different faunas, whether considered in aggregate or in terms of assemblages undergoing seasonal changes month-by-month. The differences reflect year-by-year changes in the abundances of many individual species, some of which progressively decrease, others of which progressively increase, while others of which have intermediate peaks or troughs in abundance. These patterns translate into trends of decreasing numbers of individuals and species over time, at least for the first few years. It is not possible to explain most of the species-level changes over time. However, for the weevil *Platypus subgranosus* (a pinhole borer, known for its mass attacks on freshly-dead or dying trees), its abundance peak a year or two into the study probably reflects its two-year life-cycle, meaning that the largest generation of adults emerged two years after initially optimal habitat was located by their parents.

There are few – perhaps no – experiments elsewhere with which the present study can yet be directly compared (but see Langor *et al.* (2008) for mention of some recent Canadian research). Shorter-term but still multi-year successional studies on saproxylic biota have been conducted following windstorms (Köhler, 2000 – beetles) and harvesting (Lindhe *et al.*, 2004 – fungi). Nevertheless, there are many published studies that have adopted a space-for-time approach to charting succession, generally involving studying logs or snags in a range of decompositional stages over the space of a single sample-season or year. Many of these have used eclectors, some have used flight intercept traps, and some both or other techniques. Together, they provide context for the findings from the present study.

Responses to log age (i.e. time-since-death) seem likely to differ depending on the tree species involved. In a U.S. study using eclectors to sample saproxylic beetles from loblolly pine logs between zero and nine years old (Ulyshen and Hanula, 2010), species density followed a pattern similar to the present study: it was significantly higher in the 'young-log' age-class (1-10 months), but by the 'middle-aged' age-class (46-55 months) species density had dropped substantially, and remained low in the old-log age-class (94-103 months). Likewise, in a Swedish study using trunk-mounted flight intercept traps to study saproxylic beetle assemblages on beech snags

(Brunet and Isacsson, 2009a), species density was significantly lower in snags in the oldest (decay-class 4) snags compared to snags in the younger three decay-classes. However, in another Swedish study, of saproxylic beetles associated with Swedish high stumps of three hardwood tree species, sampled yearly for seven years (Lindhe and Lindelow, 2004), there was a trend of increasing species density, peaking and stabilising in the fourth year; while in a German study (Kappes and Topp, 2004), in which eclectors were used to sample saproxylic beetles from oak and beech logs over the first six years of decomposition, no significant change in species richness was detected.

#### *Combined influences of log-class and time on the fauna*

The strong successional pattern evident in the saproxylic beetle fauna over the course of this study is overlaid on an effect of log-class, such that the two log-classes follow more-or-less separate but parallel trajectories with time-since-felling. Determining which species contribute to the separation is not straightforward when assemblages are clearly changing year-by-year. Indicator species analysis identified several species which were affiliated with either the mature or the regrowth log-class in particular years. One species that was somewhat consistently associated with the regrowth log-class is the staphylinid Aleocharinae TFIC sp 066. Very little is known about this species, other than that it is fully winged, is likely to be a predator of soft-bodied invertebrates, and seems to be obligately saproxylic. Its affiliation with the regrowth log-class remains unexplained. The only other species to show consistent affiliation to a particular log-class across two consecutive years is the anobiid *Hadrobregmus areolicolle*, which was associated with the mature log-class in Years 3 and 4. This species is a wood-borer; its affiliation with the mature log-class remains unexplained. The paucity of affiliates suggests that the differences between the two log-classes over time are the product of very subtle differences in assemblage composition and in the abundance of component species. Our succession of ordination analyses demonstrate that obligately and facultatively saproxylic species, winged and functionally flightless species all contribute to these differences, as do members of all larval feeding guilds (albeit unequally).

#### *The ecological significance of rare species*

In the present study, analyses of variance could only be performed on the 30 commonest species, and indicator species analysis inherently favours the more prevalent species. Fortunately, in employing non-metric multidimensional scaling we had no need to exclude rare species from our ordinations (though singletons contribute nothing to the resultant plots). But relying on a single ordination plot runs the risk of masking differential patterning (or responses) of rare and common species. Thus it is interesting to note that, in the present study, both the successional trajectory in assemblage composition and the differences between the two log-classes that are evident in an ordination plot for the entire data-set were also evident in sub-sets of it that were either composed of, or excluded, the rare species. This implies that these patterns are not just the product of responses of common species, but are almost equally the product of rare species. This in turn implies that the rarer species in our study were not 'tourists', but were full-blown members of the log-dwelling fauna. In a review of rare species in multivariate analyses, Cao *et al.* (2001) noted that the value of including rare species decreased at larger spatial scales, or in the presence of strong environmental gradients, because rare species are more likely to respond to local or 'less important' gradients. Presumably the gradients detected in the present study fall

into that category, even though they are the product of multiple species with a wide range of functional traits.

In situations in which rarity is in part a product of human manipulation of the environment, rather than a natural condition, maintaining the ecological function of rare species may take on greater conservation significance. This in turn presents sampling and survey challenges that must overcome the low probability of detecting rare species. In a Finnish study, Martikainen and Kouki (2003) determined that over 100,000 beetles would have to be trapped to reliably detect the presence of such rare species. Even a study of the size of the present one would be inadequate in such circumstances, though it has served as a useful benchmark nonetheless.

## Conclusion

The unusual design of this study has presented some analytical challenges, but has allowed presentation of an in-depth appraisal of the saproxylic beetle fauna of *Eucalyptus obliqua* logs at an early stage in their decomposition. It has revealed a rich but poorly described, taxonomically and ecologically diverse fauna, in which neither obligately nor facultatively saproxylic species predominate, predators predominate over other larval feeding guilds, winged species predominate over functionally flightless species, and most species are rare and few are common. The fauna shows strong seasonality, with a strong summer peak in keeping with the cool temperate climate and with some inter-annual variation in emergence times that is probably related to climatic variability.

Many species occur at very low densities and have traits that make them unable to live elsewhere and unlikely to be able to disperse long distances. The fauna changes over short time-scales as the logs decay, even within their first decade, and differs between logs derived from mature trees and those derived from regrowth trees.

While recognising that current levels of reservation of unharvested forest in Tasmania already provide a significant conservation achievement for saproxylic and other taxa, the findings from this study nevertheless point to a need to give due attention to the conservation of coarse woody debris in production forestry areas, as has been recommended in several related studies locally (Yee *et al.*, 2001; Grove and Meggs, 2003; Grove, 2009; Wardlaw *et al.*, 2009) and elsewhere (Spies *et al.*, 1988; McCarthy and Bailey, 1994; Tinker, 2001; Hautala *et al.*, 2004; Gibb *et al.*, 2005).

Smaller-diameter logs are unlikely to become scarce under current forestry practices in Tasmania (Grove *et al.*, 2002), which for the past half-century in the lowland wet eucalypt forests have been based on harvesting by clearfelling and on subsequent regeneration by burning and sowing (Gilbert and Cunningham, 1972). However, there is a need to develop measures that actively ensure connectivity in space, and continuity in time, for the larger logs derived from mature trees. One promising development is the continuing gradual replacement (on state forest at least) of clearfelling with aggregated retention silviculture, which effectively leaves about a third of each harvest-unit unharvested and retained for the long term (Forestry Tasmania, 2009). The spatial arrangement of these unharvested areas – designed to meet stringent criteria of ‘forest influence’ - is well-suited to providing for future inputs of large-diameter logs into the regenerating forest. However, the extent of replacement of clearfelling by aggregated retention will need to expand beyond that currently envisaged if it is to achieve its ecological potential. Furthermore, if current plans to integrate industrial fuelwood-harvesting with clearfelling are realised, then adopting prescriptions for the retention of coarse woody debris of all sizes at the time of harvest will become necessary; such prescriptions, which take the form of ‘virtual aggregates’, have already been prepared by the author (SG) and endorsed by Forestry Tasmania.

It should be remembered that this study was conducted in an area of forest that was very rich in mature trees and the logs generated from them. Notwithstanding the above conclusions regarding management, it would be instructive to repeat such an experiment in forest that is naturally depauperate in such trees and logs, which might provide a better natural benchmark against which to compare the likely impacts of

more intensive production forestry. Such forest might, for instance, naturally lack some of the species that contributed most to the differences in assemblage composition between the two log-classes in the present study.

A decade is not long in the life of these logs, and the Warra long-term log-decay experiment is still in its infancy. Like the 200-year log decomposition experiment at the H.J. Andrews Experimental Forest in Oregon, USA (Harmon, 1992), the intention is to continue the experiment for as long as it takes for the logs to decompose to a point at which no further sampling is possible. Over time, this will enable a more complete picture of Warra's saproxylic beetle fauna to be compiled, and a better understanding of its relationship with log-class, succession and forest management to emerge.

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Appendix 1. Details of eclectors and their periods of operation by Cycle, representing Data-set 1. Periods of operation for Data-set 4 are given in parentheses.

Log	Eclector	Dia. <sup>(1)</sup>	Vol. <sup>(2)</sup>	SA <sup>(3)</sup>	Data-set 1 – Cycle 1 (Data-set 4 in parentheses)	Data-set 1 – Cycle 2 (Data-set 4 in parentheses)
M1	M11	174	7.13	16.4	JUN-99 to SEP-02 (SEP-00 to AUG-02)	OCT-04 to MAY-06 (OCT-04 to MAY-06)
M1	M12	168	6.65	15.84	DEC-99 to NOV-02 (SEP-00 to AUG-02)	DEC-04 to NOV-06 (DEC-04 to NOV-06)
M1	M13	150	5.3	14.14	AUG-99 to MAY-03 (JUN-01 to MAY-03)	JUN-05 to MAY-07 (JUN-05 to MAY-07)
M1	M14	153	5.52	14.42	NOV-00 to NOV-03 (JUN-01 to MAY-03)	NOV-05 to NOV-07 (DEC-05 to NOV-07)
M1	M15	156	5.73	14.7	NOV-01 to APR-04 (MAR-02 to FEB-04)	JUN-06 to MAY-08 (JUN-06 to MAY-08)
M2	M21	179	7.55	16.87	JUN-99 to SEP-02 (SEP-00 to AUG-02)	OCT-04 to MAY-06 (OCT-04 to MAY-06)
M2	M22	179	7.55	16.87	DEC-99 to NOV-02 (SEP-00 to AUG-02)	DEC-04 to NOV-06 (DEC-04 to NOV-06)
M2	M23	161	6.11	15.18	AUG-00 to MAY-03 (JUN-01 to MAY-03)	JUN-05 to MAY-07 (JUN-05 to MAY-07)
M2	M24	151	5.37	14.23	NOV-00 to NOV-03 (JUN-01 to MAY-03)	NOV-05 to NOV-07 (NOV-05 to NOV-07)
M2	M25	149	5.23	14.04	NOV-01 to APR-04 (MAR-02 to APR-04)	JUN-06 to MAY-08 (JUN-06 to FEB-08)
M3	M31	133	4.17	12.54	OCT-99 to OCT-02 (SEP-00 to AUG-02)	OCT-04 to SEP-06 (NOV-04 to SEP-06)
M3	M32	118	3.28	11.12	MAY-00 to MAY-03 (SEP-00 to AUG-02)	APR-05 to MAR 3007 (APR-05 to MAR-07)
M3	M33	118	3.28	11.12	OCT-00 to NOV-03 (SEP-01 to AUG-03)	OCT-05 to SEP-07 (OCT-05 to SEP-07)
M3	M34	115	3.12	10.84	JUN-01 to DEC-03 (SEP-01 to AUG-03)	APR-06 to MAR-08 (APR-06 to MAR-08)
M3	M35	106	2.65	9.99	NOV-01 to SEP-04 (SEP-02 to AUG-04)	OCT-06 to SEP-08 (OCT-06 to SEP-08)
M4	M41	119	3.34	11.22	OCT-99 to OCT-02 (SEP-00 to AUG-02)	OCT-04 to SEP-06 (NOV-04 to SEP-06)
M4	M42	118	3.28	11.12	MAY-00 to MAY-03 (SEP-00 to AUG-02)	APR-05 to MAR-07 (APR-05 to MAR-07)
M4	M43	124	3.62	11.69	OCT-00 to NOV-03 (SEP-01 to AUG-03)	OCT-05 to SEP-07 (OCT-05 to SEP-07)
M4	M44	121	3.45	11.41	JUL-01 to APR-04 (SEP-01 to AUG-03)	APR-06 to MAR-08 (APR-06 to MAR-08)
M4	M45	124	3.62	11.69	DEC-01 to SEP-04 (SEP-02 to AUG-04)	OCT-06 to SEP-08 (OCT-06 to SEP-08)
M5	M51	139	4.55	13.1	MAY-00 to FEB-03 (SEP-00 to AUG-02)	MAR-05 to FEB-07 (MAR-05 to FEB-07)
M5	M52	133	4.17	12.54	SEP-00 to NOV-03 (SEP-00 to AUG-02)	SEP-05 to AUG-07 (SEP-05 to AUG-07)
M5	M53	134	4.23	12.63	MAR-01 to APR-04 (SEP-01 to AUG-03)	MAR-06 to FEB-08 (MAR-06 to FEB-08)
M5	M54	134	4.23	12.63	AUG-01 to JUL-04 (SEP-01 to AUG-03)	SEP-06 to AUG-08 (SEP-06 to AUG-08)
M5	M55	90	1.91	8.48	DEC-01 to NOV-04 (SEP-02 to AUG-04)	MAR-07 to FEB-09 (MAR-07 to JAN-09)
M6	M61	163	6.26	15.36	MAR-00 to FEB-03 (SEP-00 to AUG-02)	MAR-05 to FEB-07 (MAR-05 to FEB-07)
M6	M62	145	4.95	13.67	SEP-00 to NOV-03 (SEP-00 to AUG-02)	SEP-05 to AUG-07 (SEP-05 to AUG-07)
M6	M63	144	4.89	13.57	MAR-01 to APR-04 (SEP-01 to AUG-03)	MAR-06 to FEB-08 (MAR-06 to FEB-08)
M6	M64	132	4.11	12.44	AUG-01 to JUL-04 (SEP-01 to AUG-03)	SEP-06 to AUG-08 (SEP-06 to AUG-08)
M6	M65	126	3.74	11.88	DEC-01 to NOV-04 (SEP-02 to AUG-04)	MAR-07 to FEB-09 (MAR-07 to FEB-09)

Log	Eclector	Dia. <sup>(1)</sup>	Vol. <sup>(2)</sup>	SA <sup>(3)</sup>	Data-set 1 – Cycle 1 (Data-set 4 in parentheses)	Data-set 1 – Cycle 2 (Data-set 4 in parentheses)
R1	R11	36	0.31	3.39	JUN-99 to SEP-02 (SEP-00 to AUG-02)	OCT-04 to MAY-06 (OCT-04 to MAY-06)
R1	R12	33	0.26	3.11	DEC-99 to NOV-02 (SEP-00 to AUG-02)	DEC-04 to NOV-06 (DEC-04 to NOV-06)
R1	R13	31	0.23	2.92	AUG-00 to AUG-03 (JUN-01 to AUG-03)	JUN-05 to MAY-07 (JUN-05 to MAY-07)
R1	R14	30	0.21	2.83	NOV-00 to SEP-03 (JUN-01 to MAY-03)	NOV-05 to NOV-07 (NOV-05 to NOV-07)
R1	R15	25	0.15	2.36	NOV-01 to APR-04 (MAR-02 to FEB-04)	JUN-06 to MAY-08 (JUN-06 to MAY-08)
R2	R21	45	0.48	4.24	JUN-99 to SEP-02 (SEP-00 to AUG-02)	OCT-04 to MAY-06 (DEC-04 to MAY-06)
R2	R22	37	0.32	3.49	DEC-99 to NOV-02 (SEP-00 to AUG-02)	DEC-04 to NOV-06 (DEC-04 to NOV-06)
R2	R23	36	0.31	3.39	JUN-00 to MAY-03 (JUN-01 to MAY-03)	JUN-05 to MAY-07 (JUN-05 to MAY-07)
R2	R24	34	0.27	3.2	NOV-00 to NOV-03 (JUN-01 to MAY-03)	NOV-05 to NOV-07 (DEC-05 to NOV-07)
R2	R25	29	0.2	2.73	OCT-01 to APR-04 (MAR-02 to FEB-04)	JUN-06 to MAY-08 (JUN-06 to MAY-08)
R3	R31	32	0.24	3.02	OCT-99 to OCT-02 (SEP-00 to AUG-02)	OCT-04 to SEP-06 (OCT-04 to SEP-06)
R3	R32	29	0.2	2.73	MAY-00 to MAY-03 (SEP-00 to AUG-02)	APR-05 to MAR-07 (APR-05 to MAR-07)
R3	R33	28	0.18	2.64	OCT-00 to NOV-03 (SEP-01 to AUG-03)	OCT-05 to SEP-07 (OCT-05 to SEP-07)
R3	R34	26	0.16	2.45	MAY-01 to DEC-03 (SEP-01 to AUG-03)	APR-06 to MAR-08 (APR-06 to MAR-08)
R3	R35	21	0.1	1.98	DEC-01 to SEP-04 (SEP-02 to AUG-04)	OCT-06 to SEP-08 (OCT-06 to SEP-08)
R4	R41	31	0.23	2.92	OCT-99 to OCT-02 (SEP-00 to AUG-02)	OCT-04 to SEP-06 (OCT-04 to SEP-06)
R4	R42	28	0.18	2.64	MAY-00 to MAY-03 (SEP-00 to AUG-02)	APR-05 to MAR-07 (APR-05 to MAR-07)
R4	R43	26	0.16	2.45	OCT-00 to NOV-03 (SEP-01 to AUG-03)	OCT-05 to SEP-07 (OCT-05 to SEP-07)
R4	R44	22	0.11	2.07	JUN-01 to APR-04 (SEP-01 to AUG-03)	APR-06 to MAR-08 (APR-06 to MAR-08)
R4	R45	21	0.1	1.98	DEC-01 to SEP-04 (SEP-02 to AUG-04)	OCT-06 to SEP-08 (OCT-06 to SEP-08)
R5	R51	40	0.38	3.77	MAR-00 to FEB-03 (SEP-00 to AUG-02)	MAR-05 to FEB-07 (MAR-05 to FEB-07)
R5	R52	39	0.36	3.68	SEP-00 to NOV-03 (SEP-00 to AUG-02)	SEP-05 to AUG-07 (SEP-05 to AUG-07)
R5	R53	35	0.29	3.3	MAR-01 to APR-04 (SEP-01 to AUG-03)	MAR-06 to FEB-08 (MAR-06 to FEB-08)
R5	R54	34	0.27	3.2	AUG-01 to JUL-04 (SEP-01 to AUG-03)	SEP-06 to AUG-08 (SEP-06 to AUG-08)
R5	R55	33	0.26	3.11	DEC-01 to NOV-04 (SEP-02 to AUG-04)	MAR-07 to FEB-09 (MAR-07 to FEB-09)
R6	R61	52	0.64	4.9	MAR-00 to FEB-03 (SEP-00 to AUG-02)	MAR-05 to FEB-07 (MAR-05 to FEB-07)
R6	R62	47	0.52	4.43	AUG-00 to NOV-03 (SEP-00 to AUG-02)	SEP-05 to AUG-07 (SEP-05 to AUG-07)
R6	R63	45	0.48	4.24	MAR-01 to APR-04 (SEP-01 to AUG-03)	MAR-06 to FEB-08 (MAR-06 to FEB-08)
R6	R64	42	0.42	3.96	AUG-01 to JUL-04 (SEP-01 to AUG-03)	SEP-06 to AUG-08 (SEP-06 to AUG-08)
R6	R65	41	0.4	3.86	DEC-01 to NOV-04 (SEP-02 to JUL-04)	MAR-07 to FEB-09 (MAR-07 to FEB-09)

<sup>(1)</sup> Small-end diameter of logsection (cm); <sup>(2)</sup> Volume of logsection (m<sup>3</sup>); <sup>(3)</sup> Surface area of logsection (m<sup>2</sup>).

Appendix 2. Taxonomic list of beetle species, and numbers caught. **Saproxylicity categories:**  $Sx^-$  = non-saproxylic;  $Sx^+$  = at least facultatively saproxylic;  $Sx^{++}$  = obligately saproxylic. **Flightedness categories:**  $F^-$  = functionally flightless;  $F^+$  = winged and assumed capable of flight. **Larval feeding categories:** De = Detritus-feeder; Fu = fungus-feeder; Pr = predator; Wo = wood-feeder; Ot = other/unknown. **Positions** (numbers are based on the entire data-set): L = lower collecting-heads; U = upper collecting-heads. **Log-classes** (numbers are based on the entire data-set): M = mature; R = regrowth. **Cycles** (numbers are based on Data-set 1): C1 = Cycle 1; C2 = Cycle 2. **Years** (numbers are based on Data-set 2, comprising the number of groups of eclectors operating for the course of a given year-since-felling, in which there was one group in Years 0, 4, 5 and 8; three in Years 1, 3, 6 and 7; and four in Year 2): Y0-Y8 = Years 0 to 8.

	Position		Log-class		Cycle		Year								
	L	U	M	R	C1	C2	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8
<b>DYTISCIDAE</b>															
Hydroporinae															
- <i>Megaporus hamatus</i> (Clark, 1862) [ $Sx^+$ ; $F^+$ ; Pr]	2	-	1	1	2	-	-	1	1	-	-	-	-	-	-
<b>CARABIDAE</b>															
Migadopinae															
- <i>Stichonotus leai</i> Sloane, 1910 [ $Sx^+$ ; $F^+$ ; Pr]	3	-	2	1	1	2	-	-	-	1	-	-	1	1	-
Trechinae															
- <i>Sloaneana tasmaniae</i> (Sloane, 1915) [ $Sx^+$ ; $F^+$ ; Pr]	27	4	10	21	10	21	-	3	-	3	1	5	10	3	1
- <i>Trechimorphus diemenensis</i> (Bates, 1878) [ $Sx^+$ ; $F^+$ ; Pr]	65	136	134	67	193	8	30	59	29	26	5	1	3	3	-
Harpalinae															
- Harpalinae TFIC sp 01 [ $Sx^+$ ; $F^-$ ; Pr]	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-
Pseudomorphae															
- <i>Adelotopus dubius dubius</i> Baehr, 1997 [ $Sx^{++}$ ; $F^+$ ; Pr]	2	-	2	-	1	1	-	-	-	1	-	-	1	-	-
Broscinae															
- <i>Acallistus longus</i> (Sloane, 1920) [ $Sx^+$ ; $F^-$ ; Pr]	18	1	8	11	12	7	3	2	1	1	-	2	1	-	2
- <i>Chylnus ater</i> (Putzeys, 1868) [ $Sx^+$ ; $F^-$ ; Pr]	294	6	188	112	139	161	6	30	39	24	6	17	48	42	19
Callistinae															
- <i>Lestignathus foveatus</i> Sloane, 1920 [ $Sx^+$ ; $F^-$ ; Pr]	4	-	2	2	4	-	-	-	2	-	-	-	-	-	-
Lebiinae															
- <i>Agonocheila curtula</i> (Erichson, 1842) [ $Sx^+$ ; $F^+$ ; Pr]	-	1	-	1	1	-	-	-	-	-	-	-	-	-	-
Pentagonicinae															

- <i>Scopodes boops</i> Erichson, 1842 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	-	2	1	1	-	2	-	-	-	-	-	2	-	-	-
- <i>Scopodes sigillatus</i> Germar, 1848 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	4	5	7	2	8	1	-	1	1	4	-	-	1	-	-
<b>Psydrinae</b>															
- <i>Amblytelus striatus</i> Sloane, 1920 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	-	6	-	6	3	3	-	3	-	-	-	-	-	-	-
- <i>Dystrichothorax tasmaniensis</i> Baehr, 2004 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	-	1	1	-	-	-	-	1	-	-	-	-	-
<b>Pterostichinae</b>															
- <i>Loxandrus gagatinus</i> (Castelnau, 1867) [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	2	-	1	1	1	1	-	-	1	-	-	-	1	-	-
- <i>Notonomus politulus</i> (Chaudoir, 1865) [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	90	-	48	42	67	23	10	32	11	1	-	4	9	3	5
- <i>Rhabdotus reflexus</i> (Chaudoir, 1865) [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	65	1	30	36	45	21	13	9	11	7	-	5	5	2	5
<b>Agoninae</b>															
- <i>Homethes elegans</i> Newman, 1842 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	-	2	1	1	-	2	-	-	-	-	-	2	-	-	-
<b>Zolinae</b>															
- <i>Pterocyrtus tasmanicus</i> Castelnau, 1867 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	-	1	1	-	-	-	-	1	-	-	-	-	-
- <i>Pterocyrtus</i> TFIC sp 02 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	-	1	1	-	1	-	-	-	-	-	-	-	-
<b>HISTERIDAE</b>															
<b>Abraeinae</b>															
- <i>Teretriosa sorellense</i> Blackburn, 1903 [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	1	3	3	1	3	1	-	1	1	1	-	1	-	-	-
<b>PTILIIDAE</b>															
- Ptiliidae TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	2	-	1	1	-	2	-	-	-	-	-	-	-	1	-
- Ptiliidae TFIC sp 04 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	4	3	5	2	2	5	-	-	-	-	-	3	-	1	-
<b>LEIODIDAE</b>															
<b>Camiarinae</b>															
- <i>Eublackburniella</i> TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	6	1	2	5	7	-	-	2	2	2	1	-	-	-	-
- <i>Agyrtodes atropos</i> (Blackburn, 1903) [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	1	1	2	-	-	2	-	-	-	-	-	-	-	1	-
- <i>Myrmicholeva acutifrons</i> Lea, 1910 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	2	-	1	1	1	1	-	-	-	1	-	-	1	-	-
- <i>Myrmicholeva ligulata</i> Lea, 1910 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	7	-	4	3	4	3	1	1	-	1	-	-	1	1	-
- <i>Neopelatops</i> TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	9	30	33	6	39	-	1	29	2	-	-	-	-	-	-
<b>Leiodinae</b>															
- <i>Colenisia</i> TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	2	-	1	1	1	1	-	1	-	-	-	-	1	-	-
- <i>Sogdini</i> ANIC gen B TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	7	1	7	1	6	2	-	-	4	1	-	-	-	-	1
- <i>Zeadolopus</i> TFIC sp 02 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	22	3	21	4	16	9	1	2	2	8	1	1	3	4	-
<b>Coloninae</b>															
- <i>Colon</i> TFIC sp 03 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	5	-	5	-	5	-	-	-	-	1	1	-	-	-	-

- <i>Colon</i> TFIC sp 14 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	1	-	-	1	1	-	-	-	1	-	-	-	-	-	-
- <i>Colon</i> TFIC sp 18 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	6	-	6	-	6	-	-	1	2	-	-	-	-	-	-
<b>Cholevinae</b>															
- <i>Austronemadus</i> TFIC sp 03 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	57	7	36	28	39	25	8	9	3	7	1	5	10	3	2
- <i>Catoposchema tasmaniae</i> Jeannel, 1936 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	2	6	7	1	7	1	-	2	5	-	-	-	-	-	-
- <i>Choleva</i> TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	38	3	31	10	20	21	5	5	3	2	-	-	7	-	-
- <i>Cholevomorpha picta</i> Blackburn, 1891 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	1	-	1	-	1	-	1	-	-	-	-	-	-	-	-
- <i>Nargiotes gordonii</i> Giachino & Peck, 2003 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	74	14	43	45	88	-	18	25	10	6	2	-	-	-	-
- <i>Nargomorpha apicalis</i> Szymczakowski, 1963 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	2	-	2	-	2	-	2	-	-	-	-	-	-	-	-
- <i>Nargomorpha confertus</i> Szymczakowski, 1963 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	18	17	23	12	34	1	7	3	10	5	3	-	1	-	-
- <i>Nargomorpha consimilis</i> Szymczakowski, 1963 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	26	28	30	24	36	18	3	5	12	4	-	1	6	6	1
- <i>Nargomorpha globulus</i> Jeannel, 1936 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	33	6	22	17	29	10	1	5	9	9	-	-	8	2	-
- <i>Nargomorpha jeanneli</i> Szymczakowski, 1963 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	35	3	16	22	17	21	2	2	7	2	1	1	7	5	3
- <i>Nargomorpha leanus</i> Szymczakowski, 1963 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	8	1	8	1	9	-	1	4	3	-	-	-	-	-	-
- <i>Nargomorpha nitidus</i> Szymczakowski, 1963 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	2	-	1	1	2	-	-	1	-	1	-	-	-	-	-
- <i>Nargomorpha victoriensis</i> (Blackburn, 1891) [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	41	17	43	15	56	2	24	5	12	5	-	1	1	-	-
- <i>Paragyrtodes percalceatus</i> Szymczakowski, 1966 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	2	7	9	-	8	1	-	-	1	3	4	-	1	-	-
<b>STAPHYLINIDAE</b>															
<b>Microsilphinae</b>															
- <i>Microsilpha</i> ANIC Thayer sp 15 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	4	1	4	1	2	3	-	-	-	1	-	-	1	1	1
<b>Omaliinae</b>															
- <i>Ischnoderus parallelus</i> (Lea, 1906) [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	2	1	2	1	3	-	-	-	-	1	-	-	-	-	-
- <i>Phloeonomus tasmanicus</i> Blackburn, 1902 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	6	5	5	6	8	3	2	3	-	-	-	-	2	-	-
<b>Proteininae</b>															
- <i>Alloproteinus</i> ANIC Thayer sp nov [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	1	1	1	-	2	-	-	-	-	-	-	1	-	-
- <i>Anepius koebelei</i> Blackburn, 1902 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	9	-	-	9	8	1	-	1	2	2	2	-	1	-	-
- <i>Austrorhysus</i> TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	8	-	5	3	5	3	-	2	1	1	-	-	-	1	-
<b>Pselaphinae</b>															
- <i>Aulaxus</i> CHANDLER Tasmania 1 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	1	-	-	1	-	-	-	-	-	-	-	1	-
- <i>Chichester</i> CHANDLER Tasmania 1 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	5	-	4	1	5	-	-	2	1	1	-	-	-	-	-
- <i>Euplectops</i> CHANDLER Tasmania 1 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	3	1	1	3	-	4	-	-	-	-	-	-	2	2	-
- <i>Gerallus</i> CHANDLER Tasmania 1 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	-	1	1	-	-	-	1	-	-	-	-	-	-
- <i>Macroplectus</i> CHANDLER Type 1 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	6	-	3	3	6	-	-	2	-	1	1	-	-	-	-
- <i>Macroplectus tasmanicus</i> Raffray, 1904 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	2	-	1	1	1	1	-	-	-	-	1	-	1	-	-

<i>Plectusodes</i> CHANDLER Tasmania 1 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	2	-	1	1	-	2	-	-	-	-	-	-	1	1	-
- <i>Pselaphaulax</i> CHANDLER Tasmania 1 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	3	1	3	1	4	-	-	3	-	-	-	-	-	-	-
- <i>Rybaxis</i> CHANDLER Tasmania 1 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	3	-	3	-	3	-	3	-	-	-	-	-	-	-	-
- <i>Rybaxis parvidens</i> Lea, 1911 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	4	5	5	4	6	3	-	1	3	-	-	-	1	1	-
- <i>Rybaxis variabilis</i> Lea, 1911 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	5	1	5	1	4	2	-	-	2	-	1	-	-	-	2
- <i>Sagola</i> CHANDLER Tasmania 2 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	-	1	-	1	-	-	-	-	-	-	-	1	-
- <i>Startes</i> CHANDLER Tasmania 1 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	4	-	4	-	4	-	-	2	-	2	-	-	-	-	-
- <i>Tyrogetus</i> TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	1	-	2	-	2	-	-	-	-	-	-	2	-	-
Pselaphinae TFIC sp 10 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	2	-	2	-	2	-	2	-	-	-	-	-	-	-	-
- Tyrini nr <i>Tasmanityrus</i> TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	1	2	-	-	2	-	-	-	-	-	-	1	1	-
<b>Tachyporinae</b>															
- <i>Ischnosoma</i> TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	6	-	4	2	5	1	-	-	3	2	-	-	1	-	-
- <i>Sepedophilus</i> TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	72	63	82	53	68	67	6	11	21	9	8	14	30	8	3
- <i>Sepedophilus</i> TFIC sp 04 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	2	1	1	2	3	-	-	-	1	2	-	-	-	-	-
- <i>Sepedophilus</i> TFIC sp 05 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	-	1	1	-	1	-	-	-	-	1	-	-	-	-	-
- Tachyporinae TFIC sp 02 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	1	-	1	-	-	-	1	-	-	-	-	-	-
<b>Aleocharinae</b>															
- <i>Atheta</i> TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	368	125	162	331	163	330	30	39	32	16	15	14	77	97	75
- <i>Atheta</i> TFIC sp 02 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	5	-	5	-	5	-	-	-	-	-	5	-	-	-	-
- <i>Atheta</i> TFIC sp 03 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	263	80	177	166	151	192	15	36	47	16	7	21	75	40	11
- <i>Atheta</i> TFIC sp 04 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	3	-	2	1	1	2	-	1	-	-	-	-	1	-	-
- <i>Falagria</i> TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	11	3	7	7	12	2	4	3	2	3	-	-	1	1	-
- <i>Falagria</i> TFIC sp 02 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	-	1	-	1	-	-	-	-	-	-	-	-	-
- <i>Falagria</i> TFIC sp 04 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	1	1	1	2	-	-	1	-	-	-	-	-	-	-
- <i>Spanioda carissima</i> (Olliff, 1886) [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	58	9	35	32	44	23	7	6	9	6	2	3	11	4	-
- <i>Tetrabothrus claviger</i> (Fauvel, 1878) [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	6	-	3	3	5	1	2	-	-	1	-	-	-	1	-
- Aleocharinae TFIC sp 007 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	4	-	2	2	4	-	1	1	1	-	-	-	-	-	-
- Aleocharinae TFIC sp 010 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	1	1	1	2	-	-	1	-	1	-	-	-	-	-
- Aleocharinae TFIC sp 011 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	8	-	5	3	8	-	-	7	-	-	-	-	-	-	-
- Aleocharinae TFIC sp 014 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	3	-	2	1	2	1	2	-	-	-	-	-	-	-	-
- Aleocharinae TFIC sp 015 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	7	2	6	3	9	-	-	5	2	1	-	-	-	-	-
- Aleocharinae TFIC sp 018 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	1	-	1	-	-	-	-	1	-	-	-	-	-
- Aleocharinae TFIC sp 019 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	4	1	-	5	5	-	-	1	-	2	-	-	-	-	-
- Aleocharinae TFIC sp 026 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	3	-	2	1	3	-	-	1	-	1	-	-	-	-	-
- Aleocharinae TFIC sp 027 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	3	-	3	-	3	-	-	-	-	2	-	-	-	-	-

- Aleocharinae TFIC sp 038 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	-	1	1	-	-	-	-	1	-	-	-	-	-	
- Aleocharinae TFIC sp 039 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	2	-	-	2	2	-	-	-	1	-	1	-	-	-	-	
- Aleocharinae TFIC sp 040 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	2	-	1	1	2	-	-	1	-	-	-	-	-	-	-	
- Aleocharinae TFIC sp 041 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	-	1	1	-	-	-	-	1	-	-	-	-	-	
- Aleocharinae TFIC sp 066 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	872	1090	359	1603	1093	869	150	340	291	101	51	286	328	78	24	
- Aleocharinae TFIC sp 067 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	9	3	4	8	11	1	6	1	1	1	2	-	-	1	-	
- Aleocharinae TFIC sp 068 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	3	-	2	1	-	3	-	-	-	-	-	-	2	1	-	
- Aleocharinae TFIC sp 069 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	3	-	1	2	-	3	-	-	-	-	-	-	1	-	-	
- Aleocharinae TFIC sp 070 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	2	3	2	3	-	5	-	-	-	-	-	1	4	-	-	
- Aleocharinae TFIC sp 071 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	44	14	30	28	3	55	-	1	-	1	-	-	4	12	28	
- Aleocharinae TFIC sp 072 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	2	-	1	1	1	1	1	-	-	-	-	-	-	-	-	
- Aleocharinae TFIC sp 073 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	-	1	-	1	-	-	-	-	-	-	-	-	-	
- Aleocharinae TFIC sp 074 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	3	-	2	1	1	2	-	-	1	-	-	-	1	-	-	
- Aleocharinae TFIC sp 076 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	-	1	-	1	-	-	-	-	-	-	1	-	-	
- Aleocharinae TFIC sp 077 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	-	1	-	1	-	-	-	-	-	-	1	-	-	
- Aleocharinae TFIC sp 078 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	2	3	-	-	3	-	-	-	-	-	2	-	1	-	
- Aleocharinae TFIC sp 079 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	1	-	1	-	-	-	-	-	-	-	-	-	-	
- Aleocharinae TFIC sp 080 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	1	-	-	1	-	-	-	-	-	-	1	-	-	
- Aleocharinae TFIC sp 081 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	-	1	1	-	-	1	-	-	-	-	-	-	-	1	-	
- Aleocharinae TFIC sp 082 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	-	1	-	1	-	1	-	-	-	-	-	-	-	1	-	
- Aleocharinae TFIC sp 083 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	-	2	1	1	-	2	-	-	-	-	-	1	1	-	-	
- Aleocharinae TFIC sp 084 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	1	1	1	2	-	-	-	2	-	-	-	-	-	-	
- Aleocharinae TFIC sp 086 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	1	-	1	-	-	-	-	1	-	-	-	-	-	
- Aleocharinae TFIC sp 091 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	2	-	1	1	2	-	1	1	-	-	-	-	-	-	-	
- Aleocharinae TFIC sp 092 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-	
- Aleocharinae TFIC sp 093 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	13	5	6	12	18	-	3	4	1	2	4	-	-	-	-	
- Aleocharinae TFIC sp 097 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	1	-	1	-	-	-	-	-	1	-	-	-	-	
- Aleocharinae TFIC sp 105 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	-	1	1	-	1	-	-	-	1	-	-	-	-	-	-	
- Zyras TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	20	-	6	14	8	12	-	3	1	2	1	4	1	2	1	
- Zyras TFIC sp 02 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	4	2	5	1	5	1	-	1	1	-	1	-	-	-	1	
<b>Scaphidiinae</b>																
- <i>Baeocera</i> TFIC sp 02 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	7	2	8	1	7	2	1	1	2	3	-	-	1	1	-	
- <i>Scaphidium alpicolum</i> Blackburn, 1891 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	3	5	3	5	2	6	-	1	-	1	-	2	3	1	-	
- <i>Scaphisoma indutum</i> Löbl, 1977 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	1	-	1	-	1	-	-	1	-	-	-	-	-	-	-	
- <i>Scaphisoma</i> TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	1	-	1	-	1	-	-	-	-	-	-	-	-	-	-	

## Oxytelinae

- <i>Anotylus</i> TFIC sp 02 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	7	-	2	5	-	7	-	-	-	-	-	-	6	-
- <i>Homalotrichus</i> TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	-	1	-	1	-	1	-	-	-	-	-	-	1	-

## Euaesthetinae

- <i>Edaphus</i> TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	3	-	2	1	-	3	-	-	-	-	-	2	1	-
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## Paederinae

- <i>Hyperomma bryophilum</i> Lea, 1923 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	5	-	3	2	4	1	-	2	-	-	-	-	1	-
- <i>Hyperomma</i> TFIC sp 03 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	1	-	1	-	1	-	-	-	-	-	-	-
- <i>Hyperomma</i> TFIC sp 05 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	1	-	-	1	-	-	-	-	-	-	-	1
- <i>Scymbalium</i> TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	1	-	-	1	-	-	-	-	-	-	-	-

## Staphylininae

- <i>Heterothops</i> TFIC sp 05 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	-	1	1	-	-	1	-	-	-	-	-	-
- <i>Philonthus</i> TFIC sp 04 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	3	-	1	2	-	3	-	-	-	-	-	1	1	1
- <i>Philonthus</i> TFIC sp 06 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	2	-	-	2	2	-	-	-	-	1	-	-	-	-
- <i>Quedimimus hybridus</i> (Erichson, 1840) [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	-	4	3	1	1	3	-	-	-	-	-	1	1	-
- <i>Quedimimus</i> TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	-	1	1	-	1	-	-	-	-	1	-	-	-	-
- <i>Quedimimus</i> TFIC sp 02 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	1	-	-	1	-	-	-	-	-	-	-	-
- <i>Quediopsis</i> TFIC sp 02 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	7	2	7	2	3	6	-	1	-	2	-	1	3	-
- <i>Quedius</i> ANIC Newton sp 03 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	147	18	101	64	98	67	3	9	21	18	9	23	18	8
- <i>Quedius baldiensis</i> Blackburn, 1891 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	10	6	6	10	13	3	2	1	4	3	-	-	1	-
- <i>Quedius duplopunctatus</i> Lea, 1925 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	34	3	26	11	37	-	-	5	16	1	2	-	-	-
- <i>Quedius inaequalipennis</i> Lea, 1925 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	11	3	9	5	14	-	5	1	1	2	3	-	-	-
- <i>Quedius sidneensis</i> Fauvel, 1877 [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	622	1000	687	935	1090	532	391	109	403	46	5	33	192	192
- <i>Quedius</i> TFIC sp 04 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	3	1	2	2	-	4	-	-	-	-	-	-	3	-
- <i>Quedius</i> TFIC sp 06 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	8	1	3	6	9	-	-	1	-	4	-	-	-	-
- <i>Quedius</i> TFIC sp 07 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	9	8	5	12	15	2	7	2	4	1	-	1	1	-

## Scydmaeninae

- <i>Euconnus</i> TFIC sp 04 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	2	-	2	-	-	2	-	-	-	-	-	1	1	-
- <i>Euconnus</i> TFIC sp 06 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	5	-	4	1	5	-	-	1	1	-	1	-	-	-
- <i>Euconnus</i> TFIC sp 07 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	36	5	22	19	34	7	3	9	9	5	1	1	1	2
- <i>Horaeomorphus</i> TFIC sp 03 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	6	3	7	2	5	4	1	1	1	1	-	1	2	-
- <i>Horaeomorphus</i> TFIC sp 04 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	1	-	1	-	1	-	-	-	1	-	-	-	-	-
- <i>Horaeomorphus</i> TFIC sp 08 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	7	3	8	2	-	10	-	-	-	-	-	-	4	3
- <i>Horaeomorphus</i> TFIC sp 11 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	52	3	36	19	36	19	3	7	8	9	-	2	11	3
- <i>Horaeomorphus</i> TFIC sp 12 [Sx <sup>+</sup> ; F <sup>+</sup> ; Pr]	15	2	16	1	8	9	1	2	3	1	-	1	2	1

## LUCANIDAE

## Syndesinae

- *Syndesus cornutus* (Fabricius, 1801) [Sx<sup>++</sup>; F<sup>+</sup>; Wo]

4 4 4 4 8 - 2 4 1 - - - - -

## Lucaninae

- *Lissotes cancroides* (Fabricius, 1787) [Sx<sup>++</sup>; F<sup>+</sup>; Wo]

127 25 90 62 131 21 33 39 12 19 5 5 7 4 -

- *Lissotes curvicornis* (Boisduval, 1835) [Sx<sup>++</sup>; F<sup>+</sup>; Wo]

6 - - 6 6 - - - - - 6 - - - -

- *Lissotes rodwayi* Lea, 1910 [Sx<sup>++</sup>; F<sup>+</sup>; Wo]

1 - 1 - 1 - - - - 1 - - - -

- *Lissotes subcaeruleus* Bomans, 1986 [Sx<sup>++</sup>; F<sup>+</sup>; Wo]

12 2 12 2 12 2 4 2 1 1 1 - - 2 -

## SCARABAEIDAE

## Aphodiinae

- *Saprosites mendax* (Blackburn, 1892) [Sx<sup>++</sup>; F<sup>+</sup>; Ot]

59 16 69 6 52 23 2 9 - 6 1 - 4 12 1

- *Saprus griffithi* Blackburn, 1904 [Sx<sup>++</sup>; F<sup>+</sup>; Ot]

13 - 8 5 12 1 2 2 3 3 - 1 - - -

## Melolonthinae

- *Heteronyx monticola* Blackburn, 1909 [Sx<sup>-</sup>; F<sup>+</sup>; Ot]

1 - - 1 - 1 - - - - - - 1 -

- *Heteronyx pilosellus* Blanchard, 1850 [Sx<sup>-</sup>; F<sup>+</sup>; Ot]

1 - 1 - 1 - - 1 - - - - - -

- *Heteronyx tasmanicus* Blackburn, 1909 [Sx<sup>-</sup>; F<sup>+</sup>; Ot]

2 - 1 1 - 2 - - - - - - 1 -

- *Phyllochlaenia* TFIC sp 01 [Sx<sup>++</sup>; F<sup>+</sup>; Wo]

2 - 1 1 1 1 - - 1 - - - - -

- *Phyllochlaenia villosa* (Le Guillou, 1844) [Sx<sup>++</sup>; F<sup>+</sup>; Wo]

4 3 7 - 5 2 3 - - 2 - - - -

- *Telura vitticollis* Erichson, 1842 [Sx<sup>++</sup>; F<sup>+</sup>; Wo]

3 2 5 - 3 2 1 - - - 1 - 2 - -

## CLAMBIDAE

## Clambinae

- *Clambus bornemisszai* Endrody-Younga, 1990 [Sx<sup>+</sup>; F<sup>+</sup>; Fu]

22 24 44 2 46 - 42 - 2 - 1 - - -

- *Sphaerotherax tasmani* (Blackburn, 1902) [Sx<sup>+</sup>; F<sup>+</sup>; Fu]

200 154 289 65 339 15 27 110 76 73 6 - 3 6 4

## SCIRTIDAE

- *Chameloscyphon huonensis* Watts (MS name) [Sx<sup>-</sup>; F<sup>+</sup>; De]

45 6 28 23 42 9 7 10 8 5 2 - 5 2 -

- *Cyphon* TFIC sp 01 [Sx<sup>-</sup>; F<sup>+</sup>; De]

1 - - 1 1 - - - - 1 - - - -

- *Cyphon* TFIC sp 05 [Sx<sup>-</sup>; F<sup>+</sup>; De]

17 18 34 1 29 6 1 - 1 5 1 - 4 1 -

- *Cyphon* TFIC sp 06 [Sx<sup>-</sup>; F<sup>+</sup>; De]

2 2 4 - 4 - - - 3 - - - - -

- *Dapleuros tasmanicus* Watts (MS name) [Sx<sup>-</sup>; F<sup>+</sup>; De]

3 5 5 3 6 2 1 1 2 2 - - 2 - -

- *Peneveronatus tasmanicus* Armstrong, 1953 [Sx<sup>-</sup>; F<sup>+</sup>; De]

- 3 3 - 3 - 2 1 - - - - - -

- *Prionocyphon insolitus* Watts, 2010 [Sx<sup>++</sup>; F<sup>+</sup>; De]

1 10 9 2 11 - 4 3 3 - - - - -

- *Prionocyphon latusmandibularis* Watts, 2010 [Sx<sup>++</sup>; F<sup>+</sup>; De]

1 - 1 - 1 - - - - - - - - -

- *Prionocyphon warra* Watts, 2010 [Sx<sup>++</sup>; F<sup>+</sup>; De]

2 2 4 - 4 - - - 1 3 - - - - -

- <i>Pseudomicrocara rufusensis</i> Watts, 2007 [Sx <sup>-</sup> ; F <sup>+</sup> ; De]	1	-	1	-	-	1	-	-	-	-	-	-	-	-	-
- <i>Pseudomicrocara spilotus</i> (Blackburn, 1891) [Sx <sup>-</sup> ; F <sup>+</sup> ; De]	1	20	16	5	21	-	3	6	8	1	1	-	-	-	-
- <i>Pseudomicrocara variabilis</i> Armstrong, 1953 [Sx <sup>-</sup> ; F <sup>+</sup> ; De]	-	5	4	1	4	1	1	-	-	3	-	-	1	-	-
<b>BUPRESTIDAE</b>															
Buprestinae															
- <i>Nascioides quadrinotatus</i> (Van de Poll, 1889) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	1	-	1	1	-	1	-	-	-	-	-	-	-	-
<b>BYRRHIDAE</b>															
Syncalptinae															
- <i>Microchaetes bryophilus</i> Lea, 1912 [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	31	-	15	16	17	14	1	5	4	1	-	2	2	5	-
- <i>Microchaetes hystricosus</i> Lea, 1920 [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	15	-	12	3	4	11	1	-	-	1	-	-	1	6	1
- <i>Microchaetes scoparius</i> Erichson, 1842 [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	2	3	3	2	-	5	-	-	-	-	-	1	-	3	-
Byrrhinae															
- <i>Pedilophorus griffithi</i> Lea, 1907 [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	1	-	-	1	1	-	-	1	-	-	-	-	-	-	-
- <i>Pedilophorus mixtus</i> Lea, 1907 [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	-	1	-	1	-	1	-	-	-	-	-	-	1	-	-
- <i>Pedilophorus multicolor</i> Lea, 1907 [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	7	-	4	3	5	2	2	-	1	-	-	-	-	2	-
- <i>Pedilophorus</i> nr ANIC sp 04 [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	2	-	1	1	1	1	1	-	-	-	-	-	-	1	-
<b>EUCNEMIDAE</b>															
Melasinae															
- <i>Agalba flavipes</i> (Lea, 1919) [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	-	1	1	-	1	-	-	1	-	-	-	-	-	-	-
- <i>Agalba</i> MUONA sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	1	1	1	1	1	1	-	1	-	-	-	-	1	-	-
- <i>Agalba rufipennis</i> (Lea, 1919) [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	-	1	-	1	1	-	-	1	-	-	-	-	-	-	-
- <i>Neocharis</i> MUONA sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	-	6	4	2	2	4	-	1	1	-	-	1	1	1	-
<b>THROSCIDAE</b>															
Throscinae															
- <i>Aulonothroscus elongatus</i> (Bonvouloir, 1859) [Sx <sup>++</sup> ; F <sup>+</sup> ; Ot]	23	178	101	100	171	30	1	37	54	37	6	3	7	17	-
<b>ELATERIDAE</b>															
- Elateridae TFIC sp 05 [Sx <sup>++</sup> ; F <sup>+</sup> ; Ot]	-	4	2	2	4	-	4	-	-	-	-	-	-	-	-
Pityobiinae															
- <i>Parablax</i> sp nr <i>ossa</i> Calder, 1992 [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	5	9	9	5	8	6	5	1	1	1	-	-	3	1	-
- <i>Parablax</i> TFIC sp 02 [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	2	3	1	4	5	-	-	3	-	1	-	-	-	-	-
- Pityobiinae TFIC sp 02 [Sx <sup>++</sup> ; F <sup>+</sup> ; Ot]	-	2	2	-	2	-	1	1	-	-	-	-	-	-	-
Agrypninae															

- Agrypninae TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	7	13	5	15	19	1	3	4	5	1	2	-	1	-	-
<b>Denticollinae</b>															
- <i>Crepidomenus</i> TFIC sp 05 [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	-	1	-	1	-	1	-	-	-	-	-	-	-	-	1
- <i>Dicteniophorus</i> TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	-	1	-	1	-	1	-	-	-	-	-	-	1	-	-
- <i>Elatichrosis exarata</i> (Candeze, 1863) [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	-	1	-	1	1	-	-	1	-	-	-	-	-	-	-
- <i>Elatichrosis trisulcata</i> (Erichson, 1842) [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	-	1	-	1	1	-	1	-	-	-	-	-	-	-	-
- <i>Enischnelater specularis</i> (Candeze, 1889) [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	2	6	4	4	6	2	-	4	1	-	1	-	1	1	-
- <i>Enischnelater</i> TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	-	3	3	-	3	-	2	-	1	-	-	-	-	-	-
- <i>Paracrepidomenus filiformis</i> (Candeze, 1863) [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	1	10	8	3	11	-	6	1	2	-	-	-	-	-	-
- <i>Toorongus jugulatus</i> (Candeze, 1900) [Sx <sup>++</sup> ; F <sup>+</sup> ; Ot]	1	1	1	1	1	1	-	-	-	-	1	-	-	1	-
- Denticollinae TFIC sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; Ot]	3	13	11	5	10	6	4	3	1	-	-	-	2	4	-
- Denticollinae TFIC sp 02 [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	3	-	1	2	3	-	1	-	1	-	-	-	-	-	-
- Denticollinae TFIC sp 04 [Sx <sup>++</sup> ; F <sup>+</sup> ; Ot]	1	-	1	-	1	-	-	-	-	-	-	-	-	-	-
- Denticollinae TFIC sp 14 [Sx <sup>++</sup> ; F <sup>+</sup> ; Ot]	1	1	1	1	2	-	-	1	1	-	-	-	-	-	-
- Denticollinae TFIC sp 16 [Sx <sup>++</sup> ; F <sup>+</sup> ; Ot]	4	4	4	4	8	-	1	4	2	-	-	-	-	-	-
- Denticollinae TFIC sp 19 [Sx <sup>++</sup> ; F <sup>+</sup> ; Ot]	2	8	2	8	3	7	-	1	2	-	-	2	3	-	1
<b>Elaterinae</b>															
- <i>Augenotus quadriguttatus</i> (Erichson, 1842) [Sx <sup>++</sup> ; F <sup>+</sup> ; Ot]	1	12	13	-	13	-	4	8	-	-	-	-	-	-	-
- <i>Augenotus</i> TFIC sp 02 [Sx <sup>++</sup> ; F <sup>+</sup> ; Ot]	-	1	1	-	1	-	1	-	-	-	-	-	-	-	-
<b>LYCIDAE</b>															
<b>Calochrominae</b>															
- <i>Calochromus</i> TFIC sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	-	1	1	-	1	-	1	-	-	-	-	-	-	-	-
<b>Metriorrhynchinae</b>															
- <i>Porrostoma atratus</i> (Fabricius, 1801) [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	1	8	4	5	5	4	1	1	3	-	-	-	4	-	-
- <i>Porrostoma rhipidium</i> (W.S. MacLeay, 1826) [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	6	33	10	29	39	-	-	7	19	9	-	-	-	-	-
- <i>Porrostoma rufipennis</i> (Fabricius, 1801) [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	-	4	4	-	4	-	-	1	2	-	-	-	-	-	-
- <i>Porrostoma simsoni</i> (Lea, 1909) [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	-	1	-	1	-	1	-	-	-	-	-	-	1	-	-
- <i>Xylobanus insignipennis</i> (Blackburn, 1900) [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	-	3	2	1	1	2	-	1	-	-	-	-	-	-	-
<b>CANTHARIDAE</b>															
- Cantharidae TFIC sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	-	1	1	-	-	1	-	-	-	-	-	-	1	-	-
<b>Cantharinae</b>															
- <i>Heteromastix nigripes</i> Lea, 1909 [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	25	50	50	25	63	12	19	17	8	5	1	1	6	4	1
<b>DERODONTIDAE</b>															

Laricobinae															
- <i>Nothoderodontus darlingtoni</i> Lawrence, 1985 [Sx <sup>++</sup> ; F <sup>+</sup> ; De]	26	4	12	18	19	11	6	2	4	4	-	2	6	2	-
<b>DERMESTIDAE</b>															
Dermestinae															
- <i>Orphinus</i> TFIC sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; De]	-	1	1	-	1	-	-	-	-	1	-	-	-	-	-
<b>ANOBIIDAE</b>															
- Anobiidae TFIC sp 13 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	1	-	1	1	-	-	1	-	-	-	-	-	-	-
Ptininae															
- <i>Ptinus exulans</i> Erichson, 1842 [Sx <sup>++</sup> ; F <sup>+</sup> ; De]	-	4	4	-	3	1	2	1	-	-	-	-	1	-	-
Dryophilinae															
- <i>Dryophilodes</i> TFIC sp 04 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	3	1	2	3	-	-	2	1	-	-	-	-	-	-
Anobiinae															
- <i>Hadrobregmus areolicolle</i> (Lea, 1924) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	73	415	405	83	446	42	24	74	120	126	41	2	21	4	-
- <i>Hadrobregmus australiensis</i> Pic, 1901 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	1	1	-	-	1	-	-	-	-	-	-	-	-	-
Xyletininae															
- <i>Lasioderma serricorne</i> (Fabricius, 1792) [Sx <sup>++</sup> ; F <sup>+</sup> ; De]	4	2	5	1	4	2	-	2	-	1	-	-	1	1	-
<b>TROGOSSITIDAE</b>															
Rentoniinae															
- <i>Rentoniinae</i> TFIC sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	41	9	31	19	23	27	-	2	8	7	2	2	5	14	2
<b>CLERIDAE</b>															
Phyllobaeninae															
- <i>Lemidia pallida</i> Lea, 1907 [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	-	2	1	1	2	-	1	1	-	-	-	-	-	-	-
- <i>Lemidia pulchella</i> Blackburn, 1892 [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	-	3	2	1	3	-	-	3	-	-	-	-	-	-	-
- <i>Lemidia subaenea</i> Gorham, 1877 [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	-	4	3	1	4	-	2	-	1	-	-	-	-	-	-
Clerinae															
- <i>Neoscrobiger patricius</i> (Klug, 1842) [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	-	4	3	1	4	-	1	3	-	-	-	-	-	-	-
- <i>Neoscrobiger rauciceps</i> Blackburn, 1900 [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	-	2	2	-	2	-	-	2	-	-	-	-	-	-	-
Tarsosteninae															
- <i>Parapylyus bicinctus</i> (Newman, 1842) [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	-	1	1	-	1	-	-	-	-	1	-	-	-	-	-
Korynetinae															
- <i>Thriocerodes</i> TFIC sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; Pr]	-	1	1	-	1	-	1	-	-	-	-	-	-	-	-

**MELYRIDAE****Malachiinae**- *Helcogaster* TFIC sp 03 [Sx<sup>++</sup>; F<sup>+</sup>; Pr]

- 2 2 - 2 - - 2 - - - - - -

**Dasytinae**- *Dasytes* TFIC sp 01 [Sx<sup>++</sup>; F<sup>+</sup>; Pr]

- 5 4 1 4 1 - - 1 1 2 - - 1 -

**SPHINDIDAE****Sphindinae**- *Aspidiphorus humeralis* Blackburn, 1894 [Sx<sup>+</sup>; F<sup>+</sup>; Fu]

23 14 27 10 26 11 - 4 5 7 - 3 4 2 -

**NITIDULIDAE****Cillaeinae**- *Brachypeplus planus* Erichson, 1842 [Sx<sup>++</sup>; F<sup>+</sup>; De]

17 4 16 5 21 - 3 10 2 - - - - -

**Carpophilinae**- *Carpophilus hemipterus* (Linnaeus, 1758) [Sx<sup>+</sup>; F<sup>+</sup>; De]

- 1 1 - 1 - - - - - - - - -

- *Carpophilus* TFIC sp 04 [Sx<sup>+</sup>; F<sup>+</sup>; De]

- 1 1 - 1 - - - - - - - - -

**Nitidulinae**- *Epuraea victoriensis* (Blackburn, 1891) [Sx<sup>++</sup>; F<sup>+</sup>; De]

8 18 20 6 22 4 9 4 4 1 - - 1 3 -

- *Thalycrodes australe* (Germar, 1848) [Sx<sup>+</sup>; F<sup>+</sup>; De]

2 - 1 1 - 2 - - - - - - 1 - 1

- *Thalycrodes cylindricum* Blackburn, 1891 [Sx<sup>+</sup>; F<sup>+</sup>; De]

449 143 240 352 423 169 36 93 126 79 14 25 50 33 15

- *Thalycrodes pulchrum* Blackburn, 1891 [Sx<sup>+</sup>; F<sup>+</sup>; De]

67 5 34 38 52 20 10 12 12 7 - - 8 7 2

**BOGANIIDAE****Boganiinae**- *Boganium armstrongi* Sen Gupta & Crowson, 1966 [Sx<sup>+</sup>; F<sup>+</sup>; De]

- 1 - 1 1 - - - 1 - - - - -

-

**PHLOEOSTICHIDAE****Hymaeinae**- *Hymaea succinifera* Pascoe, 1869 [Sx<sup>++</sup>; F; Fu]

858 1195 1214 839 1597 456 234 543 373 177 53 56 124 113 70

**SILVANIDAE****Brontinae**- *Cryptamorpha* TFIC sp 01 [Sx<sup>++</sup>; F<sup>+</sup>; De]

1 1 1 1 2 - - - 2 - - - - -

- *Macrohyliota bicolor* (Arrow, 1901) [Sx<sup>++</sup>; F<sup>+</sup>; De]

84 224 165 143 288 20 77 86 58 22 3 2 1 12 1

- *Macrohyliota militaris* (Erichson, 1842) [Sx<sup>++</sup>; F<sup>+</sup>; De]

1 - 1 - 1 - - - - - - - - -

**LAEMOPHLOEIDAE**

- <i>Laemophloeus ramsayi</i> Olliff [Sx <sup>++</sup> ; F <sup>+</sup> ; Fu]	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
- <i>Microbrontes blackburni</i> (Grouvelle, 1902) [Sx <sup>++</sup> ; F <sup>+</sup> ; Fu]	-	1	1	-	-	1	-	-	-	-	-	-	1	-	-
- <i>Placonotus australasiae</i> [Sx <sup>++</sup> ; F <sup>+</sup> ; Fu]	1	2	1	2	2	1	-	-	-	1	-	-	-	-	-
- Laemophloeidae TFIC sp 10 [Sx <sup>++</sup> ; F <sup>+</sup> ; Fu]	-	1	-	1	1	-	-	1	-	-	-	-	-	-	-

**PHALACRIDAE**

- Phalacridae TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	1	5	3	3	6	-	-	6	-	-	-	-	-	-	-
- Phalacridae TFIC sp 05 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	3	8	9	2	11	-	-	1	-	7	2	-	-	-	-
Phalacrinae															
- <i>Litochrus alternans</i> Blackburn, 1891 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	-	4	3	1	2	2	1	-	1	-	-	1	1	-	-

**HOBARTIIDAE**

- <i>Hobartius eucalypti</i> (Blackburn, 1892) [Sx <sup>++</sup> ; F <sup>+</sup> ; Fu]	14	5	13	6	15	4	-	1	2	2	3	1	2	1	-
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**CRYPTOPHAGIDAE**

- Cryptophagidae TFIC sp 02 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	1	2	2	1	3	-	-	1	1	-	-	-	-	-	-
- Cryptophagidae TFIC sp 05 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	8	2	7	3	2	8	1	-	1	-	-	-	-	5	-
- Cryptophagidae TFIC sp 06 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	28	19	29	18	31	16	9	14	3	2	-	1	5	8	-
- Cryptophagidae TFIC sp 07 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	3	1	3	1	4	-	-	-	3	1	-	-	-	-	-
- Cryptophagidae TFIC sp 09 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	1	1	1	1	2	-	-	1	-	-	-	-	-	-	-
- Cryptophagidae TFIC sp 11 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	-	1	1	-	-	1	-	-	-	-	-	-	1	-	-
Cryptophaginae															
- <i>Cryptophagus gibbipennis</i> Blackburn, 1892 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	327	77	199	205	247	157	3	13	95	57	20	20	49	37	30
- <i>Cryptophagus tasmanicus</i> Blackburn, 1907 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	2	2	3	1	3	1	2	-	-	-	-	-	-	-	1

**EROTYLIDAE**

## Dacninae

- <i>Thallis femoralis</i> Blackburn, 1895 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	2	5	5	2	7	-	2	2	-	-	-	-	-	-	-
- <i>Thallis vinula</i> Erichson, 1842 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	10	7	14	3	17	-	-	5	6	-	-	-	-	-	-

**BIPHYLLIDAE**

- <i>Diplocoelus angustulus</i> Blackburn, 1891 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	34	18	29	23	36	16	2	6	12	6	3	-	3	2	3
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**BOTHRIDERIDAE**

## Teredinae

- <i>Teredolaemus leae</i> (Grouvelle, 1908) [Sx <sup>++</sup> ; F <sup>+</sup> ; Fu]	5	12	15	2	17	-	-	13	-	1	-	-	-	-	-
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**CERYLONIDAE**

- Cerylonidae TFIC sp 04 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	1	1	2	-	-	2	-	-	-	-	-	-	-	1	-
<b>Ceryloninae</b>															
- <i>Philothermus tasmanicus</i> Ślipiński, 1988 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	4	-	3	1	2	2	-	-	1	-	-	-	-	2	-
<b>COCCINELLIDAE</b>															
<b>Coccidulinae</b>															
- <i>Rhyzobius alphabeticus</i> Lea, 1902 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	2	15	7	10	15	2	-	6	1	6	1	-	-	1	-
- <i>Rhyzobius</i> TFIC sp 03 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	-	2	-	2	2	-	2	-	-	-	-	-	-	-	-
- <i>Rhyzobius</i> TFIC sp 04 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	-	1	1	-	1	-	-	1	-	-	-	-	-	-	-
- <i>Rhyzobius</i> TFIC sp 05 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	-	1	-	1	1	-	-	-	-	1	-	-	-	-	-
- <i>Rhyzobius</i> TFIC sp 15 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	1	8	8	1	8	1	-	4	1	1	-	-	-	-	-
- <i>Rhyzobius</i> TFIC sp 16 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	4	1	4	1	4	1	-	1	2	-	1	-	-	1	-
<b>Coccinellinae</b>															
- <i>Cleobora mellyi</i> Mulsant, 1850 [Sx <sup>-</sup> ; F <sup>+</sup> ; Pr]	-	2	1	1	-	2	-	-	-	-	-	1	-	1	-
- <i>Rodatus</i> TFIC sp 01 [Sx <sup>-</sup> ; F <sup>+</sup> ; Pr]	-	2	2	-	1	1	1	-	-	-	-	-	-	-	-
<b>CORYLOPHIDAE</b>															
<b>Corylophinae</b>															
- <i>Holopsis</i> TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	34	-	16	18	23	11	3	2	10	4	-	1	3	3	1
- <i>Holopsis</i> TFIC sp 04 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	1	-	1	-	-	1	-	-	-	-	-	1	-	-	-
- <i>Sericoderus</i> TFIC sp 02 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	2	2	2	2	2	2	-	1	1	-	-	-	-	2	-
- <i>Sericoderus</i> TFIC sp 05 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	8	3	6	5	2	9	1	-	1	-	-	-	2	3	-
<b>LATRIDIIDAE</b>															
<b>Latridiinae</b>															
- <i>Aridius minor</i> (Blackburn, 1888) [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	1	-	-	1	-	1	-	-	-	-	-	-	-	-	1
- <i>Aridius nodifer</i> (Westwood, 1838) [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	662	216	501	377	483	395	114	75	104	53	27	39	145	91	17
- <i>Enicmus priopterus</i> (Brown, 1886) [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	16	-	10	6	15	1	-	1	3	7	-	-	1	-	-
- <i>Enicmus</i> REIKE sp nov 1 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	1	-	1	-	1	-	1	-	-	-	-	-	-	-	-
- <i>Enicmus</i> REIKE sp nov 3 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	1	-	-	1	-	1	-	-	-	-	-	-	-	-	1
<b>Corticariinae</b>															
- <i>Bicava verrucifera</i> Rucker [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	6	8	10	4	9	5	-	-	1	3	2	-	1	1	1
- <i>Cortinicara</i> REIKE sp nov 1 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	3	6	6	3	9	-	2	3	-	-	1	-	-	-	-
- <i>Cortinicara</i> TFIC sp 02 [Sx <sup>+</sup> ; F <sup>+</sup> ; Fu]	2	-	2	-	-	2	-	-	-	-	-	-	-	-	2
<b>ARCHAEOCRYPTICIDAE</b>															
- <i>Enneboeus ovalis</i> Waterhouse, 1878 [Sx <sup>++</sup> ; F <sup>+</sup> ; Ot]	3	1	4	-	4	-	-	1	2	-	-	-	-	-	-

## CIIDAE

## Ciinae

- <i>Cis cervus</i> [Sx <sup>++</sup> ; F <sup>+</sup> ; Fu]	1	-	1	-	1	-	-	-	-	-	-	-	-	-	-
- <i>Cis</i> TFIC sp 04 [Sx <sup>++</sup> ; F <sup>+</sup> ; Fu]	3	-	3	-	3	-	-	-	1	-	-	-	-	-	-

## MELANDRYIDAE

- Melandryidae TFIC sp 03 [Sx <sup>++</sup> ; F <sup>+</sup> ; Fu]	-	3	-	3	3	-	-	-	1	-	2	-	-	-	-
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## Melandryinae

- <i>Callidircaea venusta</i> (Champion) [Sx <sup>++</sup> ; F <sup>+</sup> ; Fu]	-	5	4	1	2	3	-	1	1	-	-	1	-	-	-
- <i>Ctenoplectron</i> TFIC sp 02 [Sx <sup>++</sup> ; F <sup>+</sup> ; Fu]	-	2	2	-	2	-	-	-	-	1	-	-	-	-	-
- <i>Orchesia alphabetica</i> Lea [Sx <sup>++</sup> ; F <sup>+</sup> ; Fu]	72	6	48	30	58	20	10	12	14	11	1	2	3	8	2
- <i>Orchesia austrina</i> Champion [Sx <sup>++</sup> ; F <sup>+</sup> ; Fu]	3	-	3	-	3	-	2	-	1	-	-	-	-	-	-
- <i>Orchesia eucalypti</i> Lea, 1920 [Sx <sup>++</sup> ; F <sup>+</sup> ; Fu]	13	16	15	14	28	1	1	7	8	6	-	-	-	-	-
- <i>Orchesia</i> TFIC sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; Fu]	9	2	6	5	11	-	3	1	5	-	-	-	-	-	-
- <i>Orchesia</i> TFIC sp 11 [Sx <sup>++</sup> ; F <sup>+</sup> ; Fu]	-	2	2	-	-	2	-	-	-	-	-	-	1	1	-
- <i>Talayra</i> TFIC sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; Fu]	5	-	5	-	-	5	-	-	-	-	-	-	-	5	-

## MORDELLIDAE

## Mordellinae

- <i>Mordella promiscua</i> Erichson, 1842 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	3	9	2	10	11	1	1	4	2	1	2	-	-	-	1
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## ZOPHERIDAE

## Zopherinae

- <i>Ciconissus gibbicollis</i> (Champion, 1894) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	5	1	4	2	4	2	-	1	-	1	-	-	1	-	1
- <i>Latometus differens</i> Carter, 1937 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	29	13	29	13	35	7	-	2	8	16	4	1	3	2	1
- <i>Pycnomerus fuliginosus</i> (Erichson, 1842) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	4	5	6	3	6	3	-	-	3	2	-	-	1	1	-
- <i>Pycnomerus</i> TFIC sp 02 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	3	5	8	-	8	-	-	-	5	1	-	-	-	-	-

## Colydiinae

- <i>Ablabus bicolor</i> Ślipiński (MS name) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	3	-	2	1	2	1	-	-	-	2	-	-	-	1	-
- <i>Enhypon</i> TFIC sp nov 1 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	11	1	9	3	3	9	-	-	2	1	-	2	3	-	-
- <i>Enhypon tuberculatus</i> Ślipiński & Lawrence [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	7	2	7	2	5	4	-	1	1	1	-	-	-	3	-

## TENEBRIONIDAE

## Alleculinae

- <i>Apellatus tasmanicus</i> Champion, 1895 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	6	6	-	5	1	3	1	-	-	-	-	1	-	-
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## Lagriinae

- <i>Adelium abbreviatum</i> Boisduval, 1835 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	32	1	18	15	22	11	1	7	12	-	-	2	3	4	-	
- <i>Brycopia coelioides</i> (Pascoe, 1870) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	6	-	3	3	4	2	2	-	2	-	-	1	1	-	-	
- <i>Brycopia hexagona</i> Carter, 1920 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	9	1	7	3	9	1	1	2	1	1	1	-	1	-	-	
- <i>Brycopia picta</i> (Pascoe, 1869) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	9	1	2	8	4	6	-	1	1	-	-	1	3	1	-	
- <i>Coripera deplanata</i> (Boisduval, 1835) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	29	4	14	19	26	7	4	4	10	2	-	1	4	-	1	
- <i>Diemenoma commoda</i> (Pascoe, 1869) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	16	1	11	6	4	13	-	-	2	-	-	2	5	1	-	
- <i>Diemenoma</i> TFIC sp 03 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	10	5	10	5	15	-	3	5	2	1	1	-	-	-	-	
<b>Tenebrioninae</b>																
- <i>Platydema</i> sp nr <i>limacella</i> Pascoe [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	1	-	1	-	1	-	1	-	-	-	-	-	-	-	-	
<b>PROSTOMIDAE</b>																
- <i>Dryocora cephalotes</i> (Waterhouse) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	2	-	2	-	2	-	-	-	1	1	-	-	-	-	-	
- <i>Prostomis atkinsoni</i> Waterhouse, 1877 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	5	5	2	8	4	6	-	-	-	1	1	3	3	-	-	
<b>OEDEMERIDAE</b>																
<b>Oedemerinae</b>																
- <i>Asclera sublineata</i> [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	2	1	1	2	2	1	-	1	1	-	-	-	1	-	-	
- <i>Dohrnia miranda</i> Newman, 1851 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	4	17	21	-	20	1	-	10	7	-	1	-	-	-	-	
- <i>Dohrnia simplex</i> [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	91	752	669	174	765	78	123	211	207	33	60	11	50	4	5	
- <i>Pseudolycus haemorrhoidalis</i> (Fabricius, 1801) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	1	9	6	4	8	2	2	-	4	1	-	1	-	1	-	
<b>MYCTERIDAE</b>																
<b>Lacconotinae</b>																
- <i>Trichosalpingus</i> TFIC sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	2	2	-	2	-	2	-	-	-	-	-	-	-	-	
<b>PYROCHROIDAE</b>																
<b>Pilipalpinae</b>																
- <i>Temnopalpus bicolor</i> Blackburn, 1888 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	2	2	-	2	-	-	1	1	-	-	-	-	-	-	
- <i>Binburrum ruficollis</i> (Champion, 1895) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	11	8	3	10	1	2	3	2	3	-	-	-	-	-	
- <i>Binburrum</i> TFIC sp 02 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	1	1	-	1	-	-	1	-	-	-	-	-	-	-	
<b>SALPINGIDAE</b>																
<b>Salpinginae</b>																
- <i>Neosalpingus hybridus</i> (Erichson, 1842) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	8	33	26	15	27	14	-	3	5	15	2	7	5	2	-	
<b>ANTHICIDAE</b>																
- Anthicidae TFIC sp 04 [Sx <sup>++</sup> ; F <sup>+</sup> ; Ot]	-	3	2	1	3	-	-	2	-	-	-	-	-	-	-	
<b>Lemodinae</b>																

- <i>Trichananca victoriensis</i> Blackburn, 1891 [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	1	5	2	4	6	-	-	-	1	3	1	-	-	-	-	
<b>ADERIDAE</b>																
- <i>Aderus acaciae</i> (Lea, 1917) [Sx <sup>++</sup> ; F <sup>+</sup> ; De]	2	2	3	1	3	1	-	-	2	1	-	-	1	-	-	
- Aderidae TFIC sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; De]	-	1	-	1	1	-	-	1	-	-	-	-	-	-	-	
- Aderidae TFIC sp 06 [Sx <sup>++</sup> ; F <sup>+</sup> ; De]	2	10	10	2	12	-	-	1	9	-	1	-	-	-	-	
<b>SCRAPTIIDAE</b>																
Scraptiinae																
- <i>Scraptia laticollis</i> [Sx <sup>++</sup> ; F <sup>+</sup> ; De]	1	2	2	1	3	-	-	-	3	-	-	-	-	-	-	
- <i>Scraptia</i> TFIC sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; De]	-	4	4	-	4	-	-	2	1	-	-	-	-	-	-	
<b>CERAMBYCIDAE</b>																
Prioninae																
- <i>Enneaphyllus aeneipennis</i> Waterhouse, 1877 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	1	-	1	-	1	-	-	-	1	-	-	-	-	-	-	
- <i>Toxentes arcuatus</i> (Fabricius, 1787) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	1	1	-	-	1	-	-	-	-	-	-	1	-	-	
Cerambycinae																
- <i>Callidiopsis scutellaris</i> (Fabricius, 1801) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	2	40	28	14	42	-	28	1	4	-	-	-	-	-	-	
- <i>Macrones exilis</i> Newman, 1841 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	1	1	-	1	-	-	1	-	-	-	-	-	-	-	
- <i>Mecynopus cothurnatus</i> Erichson, 1842 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	1	1	-	1	-	-	-	-	-	-	-	-	-	-	
- <i>Phlyctaenodes pustulosus</i> Newman, 1840 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	1	-	1	-	1	-	-	-	-	-	-	-	-	-	-	
- <i>Stenoderus suturalis</i> (Olivier, 1795) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	1	-	1	1	-	1	-	-	-	-	-	-	-	-	
- <i>Tessaromma sericans</i> (Erichson, 1842) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	2	2	-	2	-	2	-	-	-	-	-	-	-	-	
- <i>Zoedia divisa</i> Pascoe, 1862 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	4	2	2	4	-	-	2	1	-	-	-	-	-	-	
Lamiinae																
- <i>Dorcadida bilocularis</i> White, 1846 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	7	1	6	2	8	-	3	1	-	2	1	-	-	-	-	
<b>CHRYSOMELIDAE</b>																
Chrysomelinae																
- <i>Geomela</i> TFIC sp 01 [Sx <sup>+</sup> ; F <sup>+</sup> ; De]	3	-	1	2	3	-	1	2	-	-	-	-	-	-	-	
- <i>Paropsisterna bimaculata</i> (Olivier, 1807) [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	2	60	30	32	59	3	45	7	5	-	-	1	1	1	-	
- <i>Peltoschema hamadryas</i> (Stål, 1860) [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	-	1	1	-	1	-	-	1	-	-	-	-	-	-	-	
Galerucinae																
- <i>Arsipoda bifrons</i> Erichson, 1842 [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	-	2	-	2	2	-	-	1	-	-	-	-	-	-	-	
- <i>Arsipoda erichsoni</i> Baly, 1878 [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	-	41	22	19	40	1	8	10	11	-	-	-	1	-	-	
- <i>Microdonacia incurva</i> Reid, 1992 [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	2	1	2	1	3	-	-	-	-	2	-	-	-	-	-	
- <i>Microdonacia octodentata</i> Reid, 1992 [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	1	1	2	-	2	-	-	1	1	-	-	-	-	-	-	

- <i>Monolepta</i> TFIC sp 01 [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	-	6	5	1	4	2	-	3	-	-	-	1	-	-	-
- <i>Monolepta</i> TFIC sp 02 [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	-	1	1	-	1	-	1	-	-	-	-	-	-	-	-
<b>Cryptocephalinae</b>															
- <i>Aporocera viridipennis</i> (Saunders, 1842) [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	1	-	1	-	-	1	-	-	-	-	-	-	1	-	-
- <i>Aporocera viridis</i> (Saunders, 1847) [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	-	3	2	1	3	-	-	1	2	-	-	-	-	-	-
- <i>Platycolaspis pubescens</i> Reid, 1994 [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	-	5	2	3	5	-	-	-	1	-	-	-	-	-	-
<b>Eumolpinae</b>															
- <i>Eboo elegantula</i> (Lefèvre, 1885) [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	-	3	1	2	1	2	1	-	-	-	-	2	-	-	-
- <i>Eboo viridula</i> Erichson, 1842 [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	1	19	6	14	19	1	2	10	1	-	-	1	-	-	-
<b>ANTHRIBIDAE</b>															
<b>Anthribinae</b>															
- <i>Telala</i> TFIC sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; Fu]	-	2	1	1	2	-	-	1	1	-	-	-	-	-	-
<b>Choraginae</b>															
- <i>Xynotropis</i> TFIC sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; Fu]	22	13	26	9	21	14	1	5	4	11	-	3	8	-	1
<b>ATTELABIDAE</b>															
<b>Rhynchitinae</b>															
- <i>Auletobius</i> TFIC sp 01 [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	1	-	1	-	1	-	-	-	-	1	-	-	-	-	-
- <i>Auletobius</i> TFIC sp 07 [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	2	1	1	2	-	3	-	-	-	-	-	1	1	1	-
<b>BRENTIDAE</b>															
<b>Eurhynchinae</b>															
- Eurhynchinae sp <i>quadrinodosus</i> [Sx <sup>++</sup> ; F <sup>+</sup> ; Ot]	-	1	-	1	1	-	1	-	-	-	-	-	-	-	-
<b>Apioninae</b>															
- <i>Apion tasmanicum</i> Lea, 1910 [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	4	4	5	3	7	1	-	2	2	2	-	-	1	-	-
<b>CURCULIONIDAE</b>															
<b>Molytinae</b>															
- <i>Saccolaemus</i> sp nr <i>ustulus</i> [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-
<b>Curculioninae</b>															
- <i>Ancyttalia oleariae</i> (Lea, 1906) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	2	1	1	2	-	-	1	-	-	-	-	-	-	-
- <i>Ancyttalia tarsalis</i> (Blackburn, 1894) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	5	4	1	3	2	2	-	-	-	-	-	2	-	-
- <i>Elleschodes</i> TFIC sp 03 [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	-	2	-	2	2	-	2	-	-	-	-	-	-	-	-
- <i>Elleschus wellingtoniensis</i> Lea, 1908 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	5	3	2	5	-	-	2	-	1	-	-	-	-	-
<b>Cryptorhynchinae</b>															

- <i>Decilaus bryophilus</i> Lea, 1913 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	52	81	90	43	111	22	11	36	34	8	2	2	12	5	1
- <i>Decilaus lateralis</i> Lea, 1913 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	51	3	36	18	32	22	2	5	10	6	2	3	7	7	2
- <i>Decilaus nigronotatus</i> Lea, 1913 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	66	6	45	27	53	19	8	11	9	5	5	4	5	5	2
- <i>Decilaus striatus</i> Lea, 1913 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	28	4	20	12	26	6	3	5	4	4	2	1	1	3	-
- <i>Decilaus</i> TFIC sp 01 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	13	2	5	10	6	9	-	-	2	3	-	1	2	2	-
- <i>Decilaus</i> TFIC sp 02 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	7	1	4	4	5	3	1	-	1	2	-	1	1	-	-
- <i>Decilaus</i> TFIC sp 03 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	19	6	17	8	19	6	1	9	5	-	1	-	-	2	2
- <i>Decilaus</i> TFIC sp 04 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	58	18	38	38	39	37	7	6	14	3	5	11	7	8	1
- <i>Decilaus</i> TFIC sp 19 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	2	1	3	-	2	1	-	1	1	-	-	-	-	1	-
- <i>Decilaus</i> TFIC sp 20 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	2	1	2	1	3	-	-	1	-	2	-	-	-	-	-
- <i>Exithius basipennis</i> Lea, 1913 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	1	1	2	-	2	-	1	-	-	-	-	-	-	-	-
- <i>Exithius capucinus</i> Pascoe, 1870 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	50	114	104	60	149	15	12	42	42	22	7	3	8	1	-
- <i>Exithius oculiferus</i> Lea, 1913 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	7	7	5	9	10	4	1	3	3	1	-	3	1	-	-
- <i>Exithius</i> TFIC sp 01 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	8	1	4	5	1	8	-	-	-	-	-	1	1	3	1
- <i>Exithius</i> TFIC sp 02 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	6	2	7	1	6	2	1	2	2	-	-	-	1	1	-
- <i>Exithius</i> TFIC sp 03 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	1	-	1	-	1	-	-	-	-	1	-	-	-	-	-
- <i>Exithius</i> TFIC sp 05 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	7	8	11	4	12	3	-	3	5	3	1	1	2	-	-
- <i>Exithius</i> TFIC sp 06 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	15	10	20	5	20	5	5	5	6	2	-	1	3	-	-
- <i>Exithius</i> TFIC sp 07 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	3	5	6	2	7	1	1	1	2	-	1	-	-	1	-
- <i>Exithius</i> TFIC sp 09 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	3	3	4	2	6	-	1	2	1	1	-	-	-	-	-
- <i>Exithius</i> TFIC sp 11 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	1	1	1	1	-	2	-	-	-	-	-	-	-	2	-
- <i>Exithius</i> TFIC sp 12 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	-	2	-	2	-	2	-	-	-	-	-	-	1	-	-
- <i>Exithius</i> TFIC sp 13 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	1	1	1	1	-	2	-	-	-	-	-	-	1	1	-
- <i>Exithius trisinuatus</i> Lea, 1913 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	1	-	-	1	1	-	-	1	-	-	-	-	-	-	-
- <i>Microcryptorrhynchus pygmaeus</i> Lea, 1908 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	1	2	2	1	2	1	-	-	-	2	-	-	-	1	-
- <i>Ophrythyreocis cyclothyreus</i> Lea, 1930 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	2	2	-	2	-	-	1	-	-	-	-	-	-	-
- <i>Pachyporopterus satyrus</i> (Pascoe, 1872) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	13	8	14	7	13	8	3	4	1	3	-	-	1	4	1
- <i>Poropterus alboscutellaris</i> Lea, 1911 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	25	27	32	20	33	19	8	7	6	8	4	6	7	4	1
- <i>Poropterus antiquus</i> Boheman, 1844 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	31	37	46	22	67	1	2	14	22	14	4	-	-	1	-
- <i>Poropterus montanus</i> Lea, 1909 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	1	-	-	1	1	-	-	1	-	-	-	-	-	-	-
- <i>Poropterus succisus</i> (Erichson, 1842) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	12	15	16	11	25	2	1	6	6	9	-	-	1	1	-
- <i>Poropterus zopherus</i> Lea, 1898 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	3	1	2	2	4	-	-	-	2	1	1	-	-	-	-
- <i>Pseudometyrus</i> ANIC sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	1	3	2	2	4	-	1	3	-	-	-	-	-	-	-
- <i>Pseudometyrus cylindricus</i> Lea, 1910 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	2	4	2	4	6	-	1	4	1	-	-	-	-	-	-
- <i>Pseudometyrus</i> TFIC sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	1	1	-	1	-	-	-	-	-	-	-	-	-	-
- <i>Roptoperus tasmaniensis</i> Lea, 1908 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	30	1	16	15	24	7	4	6	6	3	1	1	2	1	1

- <i>Roptoperus</i> TFIC sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	10	-	8	2	-	10	-	-	-	-	-	-	-	8	1
- <i>Tyrtaeosus ustulatus</i> Pascoe, 1870 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	29	27	2	29	-	8	15	2	-	-	-	-	-	-
- Cryptorhynchinae TFIC sp 07 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	10	1	4	7	5	6	-	3	2	-	-	1	2	2	-
- Cryptorhynchinae TFIC sp 20 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	27	9	24	12	30	6	4	7	7	6	3	-	2	3	-
- Cryptorhynchinae TFIC sp 21 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	1	1	-	1	-	-	1	-	-	-	-	-	-	-
- Cryptorhynchinae TFIC sp 48 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	2	1	1	2	-	-	1	-	-	-	-	-	-	-
<b>Dryophthorinae</b>															
- <i>Dryophthorus</i> ECZ sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	4	-	4	-	4	-	1	3	-	-	-	-	-	-	-
<b>Molytinae</b>															
- <i>Cryptoporocis</i> TFIC sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	1	-	1	-	1	-	-	-	1	-	-	-	-	-	-
- <i>Dinichus terreus</i> Pascoe, 1887 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	23	4	16	11	25	2	4	2	7	5	1	-	-	1	1
- <i>Exeiratus carinatus</i> (Lea, 1928) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	4	-	-	4	3	1	-	2	-	-	-	-	-	-	1
- <i>Exeiratus</i> TFIC sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	26	-	9	17	25	1	3	7	2	3	1	-	-	-	1
- <i>Exeiratus</i> TFIC sp 07 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	7	1	7	1	6	2	-	3	1	2	-	1	1	-	-
- <i>Orthorhinus</i> TFIC sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	2	2	-	2	-	2	-	-	-	-	-	-	-	-
<b>Cossoninae</b>															
- <i>Cossonus simsoni</i> Lea, 1910 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	3	3	-	3	-	1	1	-	-	-	-	-	-	-
- <i>Pentarthrum</i> TFIC sp 02 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	1	1	2	-	1	1	-	1	-	-	-	-	-	1	-
- <i>Pentarthrum</i> TFIC sp 03 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	-	1	-	1	1	-	-	1	-	-	-	-	-	-	-
- Cossoninae TFIC sp 06 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	1	1	2	-	1	1	-	-	-	1	-	-	-	1	-
<b>Scolytinae</b>															
- <i>Hylastes ater</i> (Paykull, 1800) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	1	-	1	-	1	-	-	-	1	-	-	-	-	-	-
- <i>Hylurgus ligniperda</i> (Fabricius, 1792) [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	2	5	6	1	-	7	-	-	-	-	-	-	7	-	-
<b>Platypodinae</b>															
- <i>Platypus subgranosus</i> Schedl, 1936 [Sx <sup>++</sup> ; F <sup>+</sup> ; Fu]	871	257	598	530	974	154	45	140	324	105	9	31	16	47	33
<b>Entiminae</b>															
- <i>Leptopius</i> TFIC sp 01 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	3	9	7	5	12	-	2	5	3	-	-	-	-	-	-
- <i>Mandalotus arciferus</i> Lea, 1907 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	4	1	5	-	4	1	1	3	-	-	-	-	1	-	-
- <i>Mandalotus muscivorus</i> Lea, 1909 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	200	11	139	72	46	165	6	17	9	6	3	13	37	54	12
- <i>Mandalotus</i> sp nr <i>vacillans</i> Lea, 1907 [Sx <sup>++</sup> ; F <sup>+</sup> ; Wo]	1	-	1	-	-	1	-	-	-	-	-	-	-	1	-
- <i>Merimnetes aequalifrons</i> [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	-	1	-	1	1	-	-	-	-	-	-	-	-	-	-
- <i>Merimnetes fagi</i> Lea, 1910 [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	5	55	34	26	55	5	14	22	11	3	1	-	3	-	-
- <i>Merimnetes oblongus</i> Blanchard [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	-	1	1	-	1	-	-	-	1	-	-	-	-	-	-
- <i>Merimnetes</i> TFIC sp 04 [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	-	1	1	-	1	-	-	-	-	1	-	-	-	-	-

- <i>Merimnetes</i> TFIC sp 09 [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	3	1	1	3	4	-	-	1	2	1	-	-	-	-	-	
- <i>Prostomus murinus</i> Lea, 1911 [Sx <sup>+</sup> ; F <sup>-</sup> ; Ot]	-	1	1	-	1	-	-	-	1	-	-	-	-	-	-	
- <i>Tapinocis scutellaris</i> Lea, 1913 [Sx <sup>++</sup> ; F <sup>-</sup> ; Wo]	1	2	3	-	3	-	-	2	1	-	-	-	-	-	-	
<b>Aterpinae</b>																
- <i>Chrysophoracis pulcher</i> Lea, 1915 [Sx <sup>+</sup> ; F <sup>+</sup> ; Ot]	1	2	2	1	3	-	2	1	-	-	-	-	-	-	-	
<b>Tychiinae</b>																
- Tychiinae TFIC sp 06 [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	-	1	1	-	1	-	1	-	-	-	-	-	-	-	-	
- Tychiinae TFIC sp 07 [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	1	2	2	1	3	-	1	-	-	1	-	-	-	-	-	
- Tychiinae TFIC sp 08 [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	-	2	-	2	2	-	-	1	1	-	-	-	-	-	-	
- Tychiinae TFIC sp 20 [Sx <sup>-</sup> ; F <sup>+</sup> ; Ot]	-	1	1	-	1	-	1	-	-	-	-	-	-	-	-	